



US009186136B2

(12) **United States Patent**
Malkowski et al.

(10) **Patent No.:** **US 9,186,136 B2**
(45) **Date of Patent:** **Nov. 17, 2015**

(54) **SURGICAL CLIP APPLIER**

(75) Inventors: **Jaroslav T. Malkowski**, Trumbull, CT
(US); **Kenneth Shaw**, Cheshire, CT
(US)

(73) Assignee: **Covidien LP**, Mansfield, MA (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 127 days.

3,675,688 A *	7/1972	Bryan et al.	140/93 D
4,242,902 A	1/1981	Green	
4,296,751 A	10/1981	Blake, III et al.	
4,372,316 A	2/1983	Blake, III et al.	
4,408,603 A	10/1983	Blake, III et al.	
4,480,640 A	11/1984	Becht	
4,480,641 A	11/1984	Failla et al.	
4,487,204 A	12/1984	Hrouda	
4,487,205 A	12/1984	Di Giovanni et al.	

(Continued)

FOREIGN PATENT DOCUMENTS

(21) Appl. No.: **12/939,296**

AU	2010200641 A1	10/2010
CN	100571640 C	12/2009

(22) Filed: **Nov. 4, 2010**

(Continued)

(65) **Prior Publication Data**

US 2011/0137323 A1 Jun. 9, 2011

OTHER PUBLICATIONS

European Search Report for EP 10252079.8-1269 date of completion
is Mar. 8, 2011 (3 pages).

(Continued)

Related U.S. Application Data

(60) Provisional application No. 61/285,006, filed on Dec.
9, 2009.

(51) **Int. Cl.**

A61B 17/068 (2006.01)

A61B 17/128 (2006.01)

A61B 19/00 (2006.01)

(52) **U.S. Cl.**

CPC **A61B 17/068** (2013.01); **A61B 17/128**
(2013.01); **A61B 2019/4815** (2013.01)

(58) **Field of Classification Search**

CPC A61B 17/068; A61B 17/0682; A61B
17/0684; A61B 2019/4815

USPC 606/139, 142, 143; 227/175.1

See application file for complete search history.

Primary Examiner — Alexander Orkin

(57)

ABSTRACT

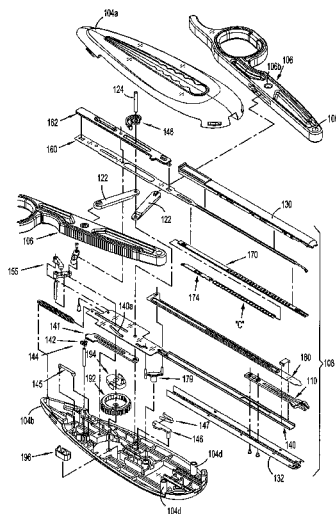
A surgical clip applier is provided including a housing; at least one handle pivotably connected to the housing; a channel assembly extending distally from the housing; a plurality of clips loaded in the clip carrier; a drive channel translatable supported in the housing and the channel assembly, the drive channel being translated upon actuation of the at least one handle; and a counter mechanism supported in the housing, the counter mechanism including indicia visible through the housing, wherein the indicia corresponds to a quantity of clips loaded in the clip applier, wherein the indicia decrements upon each firing of the clip applier resulting in a reduction in the quantity of clips remaining of the plurality of clips.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,120,230 A	2/1964	Skold
3,638,847 A	2/1972	Noiles et al.

19 Claims, 17 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

4,491,133	A	1/1985	Menges et al.	5,049,152	A	9/1991	Simon	
4,492,232	A	1/1985	Green	5,049,153	A	9/1991	Nakao et al.	
4,498,476	A	2/1985	Cerwin et al.	5,053,045	A	10/1991	Schmidt et al.	
4,500,024	A	2/1985	DiGiovanni et al.	5,059,202	A	10/1991	Liang et al.	
4,509,518	A	4/1985	McGarry et al.	5,062,563	A *	11/1991	Green et al.	227/175.3
4,512,345	A	4/1985	Green	5,062,846	A	11/1991	Oh et al.	
4,522,207	A	6/1985	Klieman et al.	5,078,731	A	1/1992	Hayhurst	
4,532,925	A	8/1985	Blake, III	5,084,057	A	1/1992	Green et al.	
4,534,351	A	8/1985	Rothfuss et al.	5,100,416	A	3/1992	Oh et al.	
4,545,377	A	10/1985	Cerwin et al.	5,100,420	A	3/1992	Green et al.	
4,549,544	A	10/1985	Favarone	5,104,394	A	4/1992	Knoepfler	
4,556,058	A	12/1985	Green	5,104,395	A	4/1992	Thornton et al.	
4,557,263	A	12/1985	Green	5,112,343	A	5/1992	Thornton	
4,562,839	A	1/1986	Blake, III et al.	5,122,150	A	6/1992	Puig	
4,572,183	A	2/1986	Juska	5,127,915	A	7/1992	Mattson	
4,576,165	A	3/1986	Green et al.	5,129,885	A	7/1992	Green et al.	
4,576,166	A	3/1986	Montgomery	5,156,608	A	10/1992	Troidl et al.	
4,590,937	A	5/1986	Deniega	5,160,339	A	11/1992	Chen et al.	
4,598,711	A	7/1986	Deniega	5,163,945	A	11/1992	Ortiz et al.	
4,602,631	A	7/1986	Funatsu	5,171,247	A	12/1992	Hughett et al.	
4,611,595	A	9/1986	Klieman et al.	5,171,249	A	12/1992	Stefanchik	
4,612,932	A	9/1986	Caspar et al.	5,171,250	A	12/1992	Yoon	
4,616,650	A	10/1986	Green et al.	5,171,251	A	12/1992	Bregen et al.	
4,616,651	A	10/1986	Golden	5,171,252	A	12/1992	Friedland	
4,624,254	A	11/1986	McGarry et al.	5,171,253	A	12/1992	Klieman	
4,637,395	A	1/1987	Caspar et al.	5,192,288	A	3/1993	Thompson et al.	
4,646,740	A	3/1987	Peters et al.	5,197,970	A	3/1993	Green et al.	
4,647,504	A	3/1987	Kimimura et al.	5,199,566	A	4/1993	Ortiz et al.	
4,658,822	A	4/1987	Kees, Jr.	5,201,746	A	4/1993	Shichman	
4,660,558	A	4/1987	Kees, Jr.	5,201,900	A	4/1993	Nardella	
4,662,373	A	5/1987	Montgomery	5,207,691	A	5/1993	Nardella	
4,662,374	A	5/1987	Blake, III	5,207,692	A	5/1993	Kraus et al.	
4,671,278	A	6/1987	Chin	5,217,473	A	6/1993	Yoon	
4,671,282	A	6/1987	Tretbar	5,219,353	A	6/1993	Garvey, III et al.	
4,674,504	A	6/1987	Klieman et al.	5,246,450	A	9/1993	Thornton et al.	
4,681,107	A	7/1987	Kees, Jr.	5,269,792	A	12/1993	Kovac et al.	
4,696,396	A	9/1987	Samuels	5,281,228	A	1/1994	Wolfson	
4,702,247	A	10/1987	Blake, III et al.	5,282,807	A	2/1994	Knoepfler	
4,706,668	A	11/1987	Backer	5,282,808	A	2/1994	Kovac et al.	
4,712,549	A	12/1987	Peters	5,282,832	A	2/1994	Toso et al.	
4,733,664	A	3/1988	Kirsch et al.	5,289,963	A	3/1994	McGarry et al.	
4,733,666	A	3/1988	Mercer, Jr.	5,290,299	A	3/1994	Fain et al.	
4,759,364	A	7/1988	Boebel	5,300,081	A	4/1994	Young et al.	
4,765,335	A	8/1988	Schmidt et al.	5,304,183	A	4/1994	Gourlay et al.	
4,777,949	A	10/1988	Perlin	5,306,280	A	4/1994	Bregen et al.	
4,777,950	A	10/1988	Kees, Jr.	5,306,283	A	4/1994	Connors	
4,796,625	A	1/1989	Kees, Jr.	5,312,426	A	5/1994	Segawa et al.	
4,799,481	A	1/1989	Transue et al.	5,330,442	A	7/1994	Green et al.	
4,815,466	A	3/1989	Perlin	5,330,487	A	7/1994	Thornton et al.	
4,817,604	A	4/1989	Smith, III	5,340,360	A	8/1994	Stefanchik	
4,821,721	A	4/1989	Chin et al.	5,342,373	A	8/1994	Stefanchik et al.	
4,822,348	A	4/1989	Casey	5,354,304	A	10/1994	Allen	
4,827,930	A	5/1989	Kees, Jr.	5,354,306	A	10/1994	Garvey, III et al.	
4,834,096	A	5/1989	Oh et al.	5,359,993	A *	11/1994	Slater et al.	600/133
4,850,355	A	7/1989	Brooks et al.	5,366,458	A	11/1994	Korthoff et al.	
4,854,317	A	8/1989	Braun	5,366,459	A	11/1994	Yoon	
4,856,517	A	8/1989	Collins et al.	5,368,600	A	11/1994	Failla et al.	
4,929,239	A	5/1990	Braun	5,381,943	A	1/1995	Allen et al.	
4,929,240	A	5/1990	Kirsch et al.	5,382,253	A	1/1995	Hogendijk	
4,931,058	A	6/1990	Cooper	5,382,254	A	1/1995	McGarry	
4,932,955	A	6/1990	Merz et al.	5,382,255	A	1/1995	Castro	
4,934,364	A	6/1990	Green	5,383,881	A	1/1995	Green	
4,943,298	A	7/1990	Fujita et al.	5,395,375	A	3/1995	Turkel et al.	
4,957,500	A	9/1990	Liang et al.	5,395,381	A	3/1995	Green	
4,966,603	A	10/1990	Focelle et al.	5,403,327	A	4/1995	Thornton et al.	
4,967,949	A	11/1990	Sandhaus	5,409,498	A	4/1995	Braddock et al.	
4,983,176	A	1/1991	Cushman et al.	5,413,584	A	5/1995	Scjulze	
4,988,355	A	1/1991	Leveen et al.	5,423,835	A	6/1995	Green	
5,002,552	A	3/1991	Casey	5,425,740	A	6/1995	Hutchinson, Jr.	
5,026,379	A	6/1991	Yoon	5,431,667	A	7/1995	Thompson	
5,030,224	A	7/1991	Wright et al.	5,431,668	A	7/1995	Burbank, III et al.	
5,030,226	A	7/1991	Green et al.	5,431,669	A	7/1995	Thompson	
5,032,127	A	7/1991	Frazee et al.	5,439,468	A	8/1995	Schulze et al.	
5,035,692	A	7/1991	Lyon et al.	5,441,509	A	8/1995	Vidal	
5,047,038	A	9/1991	Peters et al.	5,447,513	A	9/1995	Davison et al.	
				5,449,365	A	9/1995	Green	
				5,462,555	A	10/1995	Bolanos	
				5,462,558	A	10/1995	Kolesa	
				5,464,416	A	11/1995	Steckel	

(56)

References Cited

U.S. PATENT DOCUMENTS

5,474,566 A	12/1995	Alesi	5,827,306 A	10/1998	Yoon
5,474,567 A	12/1995	Stefanchik et al.	5,833,695 A	11/1998	Yoon
5,474,572 A	12/1995	Hayhurst	5,833,696 A	11/1998	Whitfield
5,487,746 A	1/1996	Yu et al.	5,833,700 A	11/1998	Fogelberg et al.
5,501,693 A	3/1996	Gravener	5,843,097 A	12/1998	Mayenberger et al.
5,509,920 A	4/1996	Phillips	5,843,101 A	12/1998	Fry
5,514,149 A	5/1996	Green	5,846,255 A	12/1998	Casey
5,520,701 A	5/1996	Lerch	5,849,019 A	12/1998	Yoon
5,522,823 A	6/1996	Kuntz et al.	5,858,018 A	1/1999	Shipp et al.
5,527,318 A	6/1996	McGarry	5,861,005 A	1/1999	Kontos
5,527,319 A	6/1996	Green	5,868,759 A	2/1999	Peyser
5,527,320 A	6/1996	Carruthers et al.	5,868,761 A	2/1999	Nicholas
5,542,949 A	8/1996	Yoon	5,876,410 A	3/1999	Petillo
5,547,474 A	8/1996	Kloeckl	5,895,394 A	4/1999	Kienzle et al.
5,569,274 A	10/1996	Rapacki et al.	5,897,565 A	4/1999	Foster
5,571,121 A	11/1996	Heifetz	5,904,693 A	5/1999	Dicesare
5,575,802 A	11/1996	McQuildin et al.	5,913,862 A	6/1999	Ramsey et al.
5,582,615 A	12/1996	Foshee et al.	5,918,791 A	7/1999	Sorrentino et al.
5,584,840 A	12/1996	Ramsey et al.	5,921,996 A	7/1999	Sherman
5,591,178 A	1/1997	Green et al.	5,921,997 A	7/1999	Fogelberg et al.
5,593,414 A	1/1997	Shipp et al.	5,928,251 A	7/1999	Aranyi
5,593,421 A	1/1997	Bauer	5,938,667 A	8/1999	Peyser
5,601,573 A	2/1997	Fogelberg et al.	5,951,574 A	9/1999	Stefanchik et al.
5,601,574 A	2/1997	Stefanchik et al.	5,972,003 A	10/1999	Rousseau
5,607,436 A	3/1997	Pratt	5,976,159 A	11/1999	Bolduc et al.
5,618,291 A	4/1997	Thompson	5,993,465 A	11/1999	Shipp et al.
5,618,306 A	4/1997	Roth et al.	6,004,335 A	12/1999	Vaitekunas et al.
5,620,452 A	4/1997	Yoon	6,017,358 A	1/2000	Yoon et al.
5,626,585 A	5/1997	Mittelstadt	6,045,560 A	4/2000	McKean et al.
5,626,586 A	5/1997	Pistl et al.	RE36,720 E	5/2000	Green
5,626,587 A	5/1997	Bishop et al.	6,059,799 A	5/2000	Aranyi
5,626,592 A	5/1997	Phillips	6,099,536 A	8/2000	Petillo
RE35,525 E	6/1997	Stefanchik et al.	6,099,537 A	8/2000	Sugai et al.
5,634,930 A	6/1997	Thornton et al.	6,139,555 A	10/2000	Hart et al.
5,643,291 A	7/1997	Pier	6,210,418 B1	4/2001	Storz et al.
5,645,551 A	7/1997	Green	6,217,590 B1	4/2001	Levinson
5,645,553 A	7/1997	Kolesa	6,228,097 B1	5/2001	Levinson et al.
5,649,937 A	7/1997	Bito et al.	6,241,740 B1	6/2001	Davis
5,653,720 A	8/1997	Johnson et al.	6,258,105 B1	7/2001	Hart et al.
5,662,676 A	9/1997	Koninckx	6,261,302 B1	7/2001	Voegelé et al.
5,662,679 A	9/1997	Voss et al.	6,273,898 B1	8/2001	Kienzle et al.
5,665,097 A	9/1997	Baker et al.	6,277,131 B1	8/2001	Kalikow
5,676,676 A	10/1997	Porter	6,306,149 B1	10/2001	Meade
5,681,330 A	10/1997	Hughett et al.	6,318,619 B1	11/2001	Lee
5,683,405 A	11/1997	Yacoubian et al.	6,322,571 B1	11/2001	Adams
5,695,502 A	12/1997	Pier	6,350,269 B1	2/2002	Shipp et al.
5,695,505 A	12/1997	Yoon	6,352,541 B1	3/2002	Kienzle et al.
5,697,938 A	12/1997	Jensen et al.	6,391,035 B1	5/2002	Appleby et al.
5,700,270 A	12/1997	Peyser	6,423,079 B1	7/2002	Blake, III
5,700,271 A	12/1997	Whitfield	6,428,548 B1	8/2002	Durgin et al.
5,702,048 A	12/1997	Eberlin	6,440,144 B1	8/2002	Bacher
5,709,706 A	1/1998	Kienzle et al.	6,461,363 B1	10/2002	Gadberry et al.
5,713,911 A	2/1998	Racenet	6,464,710 B1	10/2002	Foster
5,713,912 A	2/1998	Porter	6,494,886 B1	12/2002	Wilk et al.
5,720,756 A	2/1998	Green	6,517,536 B2	2/2003	Hooven et al.
5,722,982 A	3/1998	Ferreira et al.	6,520,972 B2	2/2003	Peters
5,725,537 A	3/1998	Green	6,527,786 B1	3/2003	Davis
5,725,538 A	3/1998	Green	6,537,289 B1	3/2003	Kayan
5,725,542 A	3/1998	Yoon	6,546,935 B2	4/2003	Hooven
5,733,295 A	3/1998	Back et al.	6,551,333 B2	4/2003	Kuhns et al.
5,755,726 A	5/1998	Pratt	6,569,171 B2	5/2003	DeGuillebon et al.
5,766,189 A	6/1998	Matsumo	6,579,304 B1	6/2003	Hart et al.
5,769,857 A	6/1998	Reztzov et al.	6,599,298 B1	7/2003	Forster et al.
5,772,673 A	6/1998	Cuny	6,602,252 B2	8/2003	Mollenauer
5,776,146 A	7/1998	Sackier et al.	6,607,540 B1	8/2003	Shipp
5,776,147 A	7/1998	Dolendo	6,613,060 B2	9/2003	Adams et al.
5,779,718 A	7/1998	Green	6,626,916 B1	9/2003	Yeung et al.
5,779,720 A	7/1998	Walder-Utz et al.	6,626,922 B1	9/2003	Hart et al.
5,782,844 A	7/1998	Yoon et al.	6,648,898 B1	11/2003	Baxter
5,788,698 A	8/1998	Savornin	6,652,538 B2	11/2003	Kayan et al.
5,792,149 A	8/1998	Sherts	6,652,539 B2	11/2003	Shipp et al.
5,792,150 A	8/1998	Pratt	6,656,193 B2	12/2003	Grant et al.
5,797,922 A	8/1998	Hessel et al.	6,673,083 B1	1/2004	Kayan
5,810,853 A	9/1998	Yoon	6,676,659 B2	1/2004	Hutchins et al.
5,817,116 A	10/1998	Takahashi et al.	6,679,894 B2	1/2004	Damarati
			RE38,445 E	2/2004	Pistl
			6,695,854 B1	2/2004	Kayan
			6,706,057 B1	3/2004	Bidoia et al.
			6,716,226 B2	4/2004	Sixto, Jr. et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

6,723,109 B2	4/2004	Solingen	7,223,271 B2	5/2007	Muramatsu et al.
6,743,240 B2	6/2004	Smith et al.	7,223,272 B2	5/2007	Francese et al.
6,773,438 B1	8/2004	Knodel et al.	7,232,445 B2	6/2007	Kortenbach et al.
6,773,440 B2	8/2004	Gannoe et al.	7,261,724 B2	8/2007	Molitor et al.
6,776,783 B1	8/2004	Frantzen et al.	7,261,725 B2	8/2007	Binmoeller
6,776,784 B2	8/2004	Ginn	7,264,625 B1	9/2007	Buncke
6,780,195 B2	8/2004	Porat	7,288,098 B2	10/2007	Huitema et al.
6,793,663 B2	9/2004	Kneifel et al.	7,297,149 B2	11/2007	Vitali et al.
6,793,664 B2	9/2004	Mazzocchi et al.	7,316,693 B2	1/2008	Viola
6,802,848 B2	10/2004	Anderson et al.	7,316,696 B2	1/2008	Wilson, Jr. et al.
6,814,742 B2	11/2004	Kimura et al.	7,326,223 B2	2/2008	Wilson, Jr.
6,818,009 B2	11/2004	Hart et al.	7,329,266 B2	2/2008	Royse et al.
6,821,273 B2	11/2004	Mollenauer	7,331,968 B2	2/2008	Arp et al.
6,821,284 B2	11/2004	Sturtz et al.	7,338,503 B2	3/2008	Rosenberg et al.
6,824,547 B2	11/2004	Wilson, Jr. et al.	7,357,805 B2	4/2008	Masuda et al.
6,824,548 B2	11/2004	Smith et al.	7,510,562 B2	3/2009	Lindsay
6,835,199 B2	12/2004	McGuckin, Jr. et al.	7,637,917 B2	12/2009	Whitfield
6,835,200 B2	12/2004	Laufer et al.	7,695,482 B2	4/2010	Viola
6,837,893 B2	1/2005	Miller	7,717,926 B2	5/2010	Whitfield
6,837,894 B2	1/2005	Pugsley, Jr. et al.	7,727,248 B2	6/2010	Smith et al.
6,837,895 B2	1/2005	Mayenberger	7,819,886 B2	10/2010	Whitfield
6,840,945 B2	1/2005	Manetakakis et al.	7,887,553 B2	2/2011	Lehman et al.
6,843,794 B2	1/2005	Sixto, Jr. et al.	7,905,890 B2	3/2011	Whitfield
6,849,078 B2	2/2005	Durgin et al.	7,942,885 B2	5/2011	Sixto, Jr. et al.
6,849,079 B1	2/2005	Blake, III et al.	7,963,433 B2	6/2011	Whitman et al.
6,853,879 B2	2/2005	Sunaoshi	7,988,027 B2	8/2011	Olson
6,869,435 B2	3/2005	Blake, III	8,011,550 B2	9/2011	Aranyi
6,869,436 B2	3/2005	Wendlandt	8,011,555 B2	9/2011	Tarinelli
6,889,116 B2	5/2005	Jinno	8,016,178 B2	9/2011	Olson
6,896,682 B1	5/2005	McClellan et al.	8,021,375 B2	9/2011	Aldrich
6,905,503 B2	6/2005	Gifford, III et al.	8,021,378 B2	9/2011	Sixto, Jr.
6,911,032 B2	6/2005	Jugenheimer et al.	8,056,565 B2	11/2011	Zergiebel
6,911,033 B2	6/2005	de Guillebon et al.	8,062,310 B2	11/2011	Shibata et al.
6,913,607 B2	7/2005	Ainsworth et al.	8,066,721 B2	11/2011	Kortenbach et al.
6,916,327 B2	7/2005	Northrup, III et al.	8,066,722 B2	11/2011	Miyagi et al.
6,923,818 B2	8/2005	Muramatsu et al.	8,070,760 B2	12/2011	Fujita
6,939,356 B2	9/2005	Debbas	8,080,021 B2	12/2011	Griego
6,942,674 B2	9/2005	Belef et al.	8,083,668 B2	12/2011	Durgin
6,942,676 B2	9/2005	Buelna	8,088,061 B2	1/2012	Wells
6,945,978 B1	9/2005	Hyde	8,091,755 B2	1/2012	Kayan
6,945,979 B2	9/2005	Kortenbach et al.	8,100,926 B1	1/2012	Filshie et al.
6,949,107 B2	9/2005	McGuckin, Jr. et al.	8,128,643 B2	3/2012	Aranyi
6,953,465 B2	10/2005	Dieck et al.	8,142,451 B2	3/2012	Boulnois
6,955,643 B2	10/2005	Gellman et al.	8,157,149 B2	4/2012	Olson
6,959,852 B2	11/2005	Shelton, IV et al.	8,157,151 B2	4/2012	Ingmanson
6,960,218 B2	11/2005	Rennich	8,172,859 B2	5/2012	Matsuno et al.
6,960,221 B2	11/2005	Ho et al.	8,172,870 B2	5/2012	Shipp
6,962,594 B1	11/2005	Thevenet	8,187,290 B2	5/2012	Buckman et al.
6,963,792 B1	11/2005	Green	8,211,120 B2	7/2012	Itoh
6,964,363 B2	11/2005	Wales et al.	8,211,124 B2	7/2012	Ainsworth et al.
6,964,668 B2	11/2005	Modesitt et al.	8,216,255 B2	7/2012	Smith et al.
6,966,875 B1	11/2005	Longobardi	8,216,257 B2	7/2012	Huitema
6,966,917 B1	11/2005	Suyker et al.	8,236,012 B2	8/2012	Molitor
6,966,919 B2	11/2005	Sixto, Jr. et al.	8,246,634 B2	8/2012	Huitema
6,969,391 B1	11/2005	Gazzani	8,246,635 B2	8/2012	Huitema
6,972,023 B2	12/2005	Whayne et al.	8,262,678 B2	9/2012	Matsuoka et al.
6,972,027 B2	12/2005	Fallin et al.	8,262,679 B2	9/2012	Nguyen
6,973,770 B2	12/2005	Schnipke et al.	8,267,944 B2	9/2012	Sorrentino
6,974,462 B2	12/2005	Sater	8,267,945 B2	9/2012	Nguyen
6,974,466 B2	12/2005	Ahmed et al.	8,267,946 B2	9/2012	Whitfield
6,974,475 B1	12/2005	Wall	8,282,655 B2	10/2012	Whitfield
6,981,505 B2	1/2006	Krause et al.	8,308,743 B2	11/2012	Matsuno et al.
6,981,628 B2	1/2006	Wales	8,328,822 B2	12/2012	Huitema
6,991,635 B2	1/2006	Takamoto et al.	8,336,556 B2	12/2012	Zergiebel
7,052,504 B2	5/2006	Hughett	8,348,130 B2	1/2013	Shah
7,056,330 B2	6/2006	Gayton	8,357,171 B2	1/2013	Whitfield
7,108,703 B2	9/2006	Danitz et al.	8,366,726 B2	2/2013	Dennis
7,144,402 B2	12/2006	Kuester, III	8,371,491 B2	2/2013	Huitema
7,175,648 B2	2/2007	Nakao	8,372,095 B2	2/2013	Viola
7,179,265 B2	2/2007	Manetakakis et al.	8,382,773 B2	2/2013	Whitfield
7,207,997 B2	4/2007	Shipp et al.	8,398,655 B2	3/2013	Cheng et al.
7,211,091 B2	5/2007	Fowler et al.	8,403,945 B2	3/2013	Whitfield
7,211,092 B2	5/2007	Hughett	8,403,946 B2	3/2013	Whitfield
7,214,230 B2	5/2007	Brock et al.	8,409,222 B2	4/2013	Whitfield
7,214,232 B2	5/2007	Bowman et al.	8,409,223 B2	4/2013	Sorrentino
			8,419,752 B2	4/2013	Sorrentino
			8,430,892 B2	4/2013	Bindra
			8,444,660 B2	5/2013	Adams
			8,465,502 B2	6/2013	Zergiebel

(56)

References Cited

U.S. PATENT DOCUMENTS

8,475,473 B2	7/2013	Vandenbroek	2005/0090838 A1	4/2005	Sixto, Jr. et al.
8,480,688 B2	7/2013	Boulnois	2005/0096670 A1	5/2005	Wellman et al.
8,486,091 B2	7/2013	Sorrentino	2005/0096671 A1	5/2005	Wellman et al.
8,491,608 B2	7/2013	Sorrentino	2005/0096672 A1	5/2005	Manetakis et al.
8,496,673 B2	7/2013	Nguyen	2005/0101975 A1	5/2005	Nguyen et al.
8,506,580 B2	8/2013	Zergiebel	2005/0107807 A1	5/2005	Nakao
8,512,357 B2	8/2013	Viola	2005/0107809 A1	5/2005	Litscher et al.
8,523,882 B2	9/2013	Huitema	2005/0107810 A1	5/2005	Morales et al.
8,529,585 B2	9/2013	Jacobs	2005/0107811 A1	5/2005	Starksen et al.
8,529,586 B2	9/2013	Rosenberg	2005/0107812 A1	5/2005	Starksen et al.
8,529,588 B2	9/2013	Ahlberg	2005/0107871 A1	5/2005	Realyvasquez et al.
8,545,486 B2	10/2013	Malkowski	2005/0113847 A1	5/2005	Gadberry et al.
8,556,920 B2	10/2013	Huitema et al.	2005/0119671 A1	6/2005	Reydel et al.
8,568,430 B2	10/2013	Shipp	2005/0119673 A1	6/2005	Gordon et al.
8,579,918 B2	11/2013	Whitfield	2005/0119677 A1	6/2005	Shipp
8,585,717 B2	11/2013	Sorrentino	2005/0125010 A1	6/2005	Smith et al.
8,603,109 B2	12/2013	Aranyi	2005/0143767 A1	6/2005	Kimura et al.
8,652,151 B2	2/2014	Lehman et al.	2005/0149063 A1	7/2005	Young et al.
8,652,152 B2	2/2014	Aranyi et al.	2005/0149064 A1	7/2005	Peterson et al.
8,663,247 B2	3/2014	Menn et al.	2005/0149068 A1	7/2005	Williams et al.
8,685,048 B2	4/2014	Adams et al.	2005/0149069 A1	7/2005	Bertolero et al.
8,690,899 B2	4/2014	Kogiso et al.	2005/0165415 A1	7/2005	Wales
8,709,027 B2	4/2014	Adams et al.	2005/0165418 A1	7/2005	Chan
8,720,766 B2	5/2014	Hess et al.	2005/0171560 A1	8/2005	Hughett
8,734,469 B2	5/2014	Pribanic et al.	2005/0175703 A1	8/2005	Hunter
8,747,423 B2	6/2014	Whitfield et al.	2005/0177176 A1	8/2005	Gerbi et al.
8,753,356 B2	6/2014	Vitali et al.	2005/0177177 A1	8/2005	Viola
8,814,884 B2	8/2014	Whitfield et al.	2005/0203547 A1	9/2005	Weller et al.
8,821,516 B2	9/2014	Huitema	2005/0203548 A1	9/2005	Weller et al.
8,839,954 B2	9/2014	Disch	2005/0216036 A1	9/2005	Nakao
8,845,659 B2	9/2014	Whitfield et al.	2005/0216056 A1	9/2005	Valdevit et al.
8,894,665 B2	11/2014	Sorrentino et al.	2005/0222588 A1	10/2005	Vandenbroek et al.
8,894,666 B2	11/2014	Schulz et al.	2005/0222590 A1	10/2005	Gadberry et al.
8,920,438 B2	12/2014	Aranyi et al.	2005/0222665 A1	10/2005	Aranyi
8,961,542 B2	2/2015	Whitfield et al.	2005/0228411 A1	10/2005	Manzo
8,968,337 B2	3/2015	Whitfield et al.	2005/0228416 A1	10/2005	Burbank et al.
8,973,804 B2	3/2015	Hess et al.	2005/0234478 A1	10/2005	Wixey et al.
9,011,464 B2	4/2015	Zammataro	2005/0251183 A1	11/2005	Buckman et al.
9,011,465 B2	4/2015	Whitfield et al.	2005/0251184 A1	11/2005	Anderson
2001/0047178 A1	11/2001	Peters	2005/0256529 A1	11/2005	Yawata et al.
2002/0068947 A1	6/2002	Kuhns et al.	2005/0267495 A1	12/2005	Ginn et al.
2002/0082618 A1	6/2002	Shipp et al.	2005/0273122 A1	12/2005	Theroux et al.
2002/0087169 A1	7/2002	Brock et al.	2005/0277951 A1	12/2005	Smith et al.
2002/0087170 A1	7/2002	Kuhns et al.	2005/0277952 A1	12/2005	Arp et al.
2002/0099388 A1	7/2002	Mayenberger	2005/0277953 A1	12/2005	Francese et al.
2002/0120279 A1	8/2002	Deguillebon et al.	2005/0277954 A1	12/2005	Smith et al.
2002/0128668 A1	9/2002	Manetakis et al.	2005/0277955 A1	12/2005	Palmer et al.
2002/0177859 A1	11/2002	Monassevitch et al.	2005/0277956 A1	12/2005	Francese et al.
2002/0198537 A1	12/2002	Smith et al.	2005/0277958 A1	12/2005	Levinson
2002/0198538 A1	12/2002	Kortenbach et al.	2005/0288689 A1	12/2005	Kammerer et al.
2002/0198539 A1	12/2002	Sixto, Jr. et al.	2005/0288690 A1	12/2005	Bourque et al.
2002/0198540 A1	12/2002	Smith et al.	2006/0004388 A1	1/2006	Whayne et al.
2002/0198541 A1	12/2002	Smith et al.	2006/0004390 A1	1/2006	Rosenberg et al.
2003/0014060 A1	1/2003	Wilson, Jr. et al.	2006/0009789 A1	1/2006	Gambale et al.
2003/0018345 A1	1/2003	Green	2006/0009790 A1	1/2006	Blake, III et al.
2003/0023249 A1	1/2003	Manetakis	2006/0009792 A1	1/2006	Baker et al.
2003/0040759 A1	2/2003	de Guillebon et al.	2006/0020270 A1	1/2006	Jabba et al.
2003/0105476 A1	6/2003	Sancoff et al.	2006/0020271 A1	1/2006	Stewart et al.
2003/0114867 A1	6/2003	Bolduc et al.	2006/0047305 A1	3/2006	Ortiz et al.
2003/0135224 A1	7/2003	Blake, III	2006/0047306 A1	3/2006	Ortiz et al.
2003/0167063 A1	9/2003	Kerr	2006/0064117 A1	3/2006	Aranyi et al.
2003/0208231 A1	11/2003	Williamson, IV et al.	2006/0079115 A1	4/2006	Aranyi
2003/0225423 A1	12/2003	Huitema	2006/0079912 A1	4/2006	Whitfield et al.
2003/0233105 A1	12/2003	Gayton	2006/0079913 A1	4/2006	Whitfield et al.
2004/0010272 A1	1/2004	Manetakis et al.	2006/0085015 A1	4/2006	Whitfield et al.
2004/0097970 A1	5/2004	Hughett	2006/0100649 A1	5/2006	Hart
2004/0097971 A1	5/2004	Hughett	2006/0111731 A1	5/2006	Manzo
2004/0138681 A1	7/2004	Pier	2006/0129170 A1	6/2006	Royce et al.
2004/0153100 A1	8/2004	Ahlberg et al.	2006/0163312 A1	7/2006	Viola et al.
2004/0167545 A1 *	8/2004	Sadler et al. 606/142	2006/0173470 A1	8/2006	Oray et al.
2004/0193213 A1	9/2004	Aranyi	2006/0178683 A1	8/2006	Shimoji et al.
2005/0070925 A1 *	3/2005	Shelton et al. 606/142	2006/0184182 A1	8/2006	Aranyi et al.
2005/0080440 A1	4/2005	Durgin et al.	2006/0190013 A1	8/2006	Menn
2005/0085830 A1	4/2005	Lehman et al.	2006/0195125 A1	8/2006	Sakakine et al.
2005/0090837 A1	4/2005	Sixto, Jr. et al.	2006/0200179 A1	9/2006	Barker et al.
			2006/0217749 A1	9/2006	Wilson, Jr. et al.
			2006/0224170 A1	10/2006	Duff
			2006/0235437 A1	10/2006	Vitali et al.
			2006/0235438 A1	10/2006	Huitema et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2006/0235439 A1 10/2006 Molitor et al.
 2006/0235440 A1 10/2006 Huitema et al.
 2006/0235441 A1 10/2006 Huitema et al.
 2006/0235442 A1 10/2006 Huitema
 2006/0235443 A1 10/2006 Huitema et al.
 2006/0235444 A1 10/2006 Huitema et al.
 2006/0259045 A1 11/2006 Damarati
 2006/0259049 A1 11/2006 Harada et al.
 2006/0264987 A1 11/2006 Sgro
 2006/0271072 A1 11/2006 Hummel et al.
 2007/0016228 A1 1/2007 Salas
 2007/0021761 A1 1/2007 Phillips
 2007/0023476 A1 2/2007 Whitman et al.
 2007/0023477 A1 2/2007 Whitman et al.
 2007/0027458 A1 2/2007 Sixto, Jr. et al.
 2007/0034669 A1 2/2007 De La Torre et al.
 2007/0038233 A1 2/2007 Martinez et al.
 2007/0049947 A1 3/2007 Menn et al.
 2007/0049948 A1 3/2007 Menn et al.
 2007/0049949 A1 3/2007 Manetakakis
 2007/0049950 A1 3/2007 Theroux et al.
 2007/0049951 A1 3/2007 Menn
 2007/0049953 A2 3/2007 Shimoji et al.
 2007/0073314 A1 3/2007 Gadberry et al.
 2007/0083218 A1 4/2007 Morris
 2007/0093856 A1 4/2007 Whitfield et al.
 2007/0106314 A1 5/2007 Dunn
 2007/0112365 A1 5/2007 Hilal et al.
 2007/0118155 A1 5/2007 Goldfarb et al.
 2007/0118161 A1 5/2007 Kennedy et al.
 2007/0118163 A1 5/2007 Boudreaux et al.
 2007/0118174 A1 5/2007 Chu
 2007/0123916 A1 5/2007 Maier et al.
 2007/0142848 A1 6/2007 Ainsworth et al.
 2007/0142851 A1 6/2007 Sixto, Jr. et al.
 2007/0149988 A1 6/2007 Michler et al.
 2007/0149989 A1 6/2007 Santili et al.
 2007/0162060 A1 7/2007 Wild
 2007/0185504 A1 8/2007 Manetakakis et al.
 2007/0191868 A1 8/2007 Theroux et al.
 2007/0213747 A1 9/2007 Monassevitch et al.
 2007/0250080 A1 10/2007 Jones et al.
 2007/0265640 A1 11/2007 Kortenbach et al.
 2007/0276417 A1 11/2007 Mendes, Jr. et al.
 2007/0282355 A1 12/2007 Brown et al.
 2007/0288039 A1 12/2007 Aranyi
 2007/0293875 A1 12/2007 Soetikno et al.
 2008/0004636 A1 1/2008 Walberg et al.
 2008/0004637 A1 1/2008 Klassen et al.
 2008/0004639 A1 1/2008 Huitema et al.
 2008/0015615 A1 1/2008 Molitor et al.
 2008/0027465 A1 1/2008 Vitali et al.
 2008/0027466 A1 1/2008 Vitali et al.
 2008/0045981 A1 2/2008 Margolin et al.
 2008/0051808 A1 2/2008 Rivera et al.
 2008/0065118 A1 3/2008 Damarati
 2008/0065119 A1 3/2008 Viola
 2008/0243145 A1 10/2008 Whitfield et al.
 2009/0045242 A1* 2/2009 Viola 227/177.1
 2010/0057105 A1 3/2010 Sorrentino
 2010/0057107 A1 3/2010 Sorrentino
 2010/0274262 A1 10/2010 Schulz et al.
 2010/0274264 A1 10/2010 Schulz et al.
 2011/0087242 A1 4/2011 Pribanic
 2011/0137323 A1 6/2011 Malkowski
 2011/0208212 A1 8/2011 Zergiebel
 2011/0224701 A1 9/2011 Menn
 2011/0245847 A1 10/2011 Menn
 2012/0029534 A1 2/2012 Whitfield
 2012/0109158 A1 5/2012 Zammataro
 2012/0116420 A1 5/2012 Sorrentino
 2012/0123446 A1 5/2012 Aranyi
 2012/0197269 A1 8/2012 Zammataro
 2012/0265220 A1 10/2012 Menn
 2012/0277765 A1 11/2012 Zammataro

2012/0330326 A1 12/2012 Creston
 2013/0110135 A1 5/2013 Whitfield
 2013/0131697 A1 5/2013 Hartoumbekis
 2013/0165951 A1 6/2013 Blake, III
 2013/0165952 A1 6/2013 Whitfield
 2013/0172910 A1 7/2013 Malkowski
 2013/0172911 A1 7/2013 Rockrohr
 2013/0172912 A1 7/2013 Whitfield
 2013/0190779 A1 7/2013 Whitfield
 2013/0190780 A1 7/2013 Whitfield
 2013/0253541 A1 9/2013 Zergiebel
 2013/0274767 A1 10/2013 Sorrentino
 2013/0289583 A1 10/2013 Zergiebel
 2013/0296891 A1 11/2013 Hartoumbekis
 2013/0296892 A1 11/2013 Sorrentino
 2013/0310849 A1 11/2013 Malkowski
 2013/0325040 A1 12/2013 Zammataro
 2014/0039526 A1 2/2014 Malkowski
 2014/0052157 A1 2/2014 Whitfield et al.
 2014/0058412 A1 2/2014 Aranyi et al.
 2014/0194903 A1 7/2014 Malkowski et al.
 2014/0207156 A1 7/2014 Malkowski
 2014/0316441 A1 10/2014 Zergiebel et al.
 2014/0330291 A1 11/2014 Whitfield et al.
 2015/0005790 A1 1/2015 Whitfield et al.
 2015/0032131 A1 1/2015 Sorrentino et al.
 2015/0066057 A1 3/2015 Rockrohr et al.
 2015/0080916 A1 3/2015 Aranyi et al.
 2015/0127022 A1 5/2015 Whitfield et al.

FOREIGN PATENT DOCUMENTS

CN 101664329 A 3/2010
 DE 20 2009 006113 7/2009
 EP 0 086 721 8/1983
 EP 0085931 A2 8/1983
 EP 0 089 737 A1 9/1983
 EP 0324166 A2 7/1989
 EP 0392750 A1 10/1990
 EP 0 409 569 A1 1/1991
 EP 0 569 223 11/1993
 EP 0 594 003 4/1994
 EP 0 598 529 A2 5/1994
 EP 0 769 275 A1 5/1994
 EP 0 685 204 A1 12/1995
 EP 0 732 078 A2 9/1996
 EP 0 755 655 A2 1/1997
 EP 0 769 274 4/1997
 EP 0 769 274 A1 4/1997
 EP 0 769 275 A1 4/1997
 EP 0 834 286 A1 4/1998
 EP 1 317 906 A1 6/2003
 EP 1 609 427 A1 12/2005
 EP 1 712 187 10/2006
 EP 1 712 191 A2 10/2006
 EP 1 757 236 2/2007
 EP 1 813 199 A1 8/2007
 EP 1 894 531 A2 3/2008
 EP 1 908 423 4/2008
 EP 1 908 423 A2 4/2008
 EP 1 913 881 A1 4/2008
 EP 1 939 231 A1 7/2008
 EP 2 229 895 A1 9/2010
 EP 2 332 471 6/2011
 EP 2 412 318 A2 2/2012
 GB 2073022 A 10/1981
 JP 10-118083 A 5/1998
 JP 2003 033361 A 2/2003
 JP 2006-501954 A 1/2006
 JP 2006-154230 A 6/2006
 JP 2006-209948 A 8/2006
 JP 2006-277221 A 10/2006
 JP 2007-250843 A 9/2007
 JP 2008-017876 A 1/2008
 JP 2008-047498 A 2/2008
 JP 2008-055165 A 3/2008
 JP 2008-515550 A 5/2008
 JP 2009-198991 A 9/2009
 JP 54-99386 B2 5/2014

(56)

References Cited

FOREIGN PATENT DOCUMENTS

WO	WO 01/66001	9/2001
WO	WO 01/67965	9/2001
WO	WO 03/086207	10/2003
WO	WO 03/092473	11/2003
WO	2004-032762 A1	4/2004
WO	WO 2005/091457 A1	9/2005
WO	WO 2006/042076	4/2006
WO	WO 2006/042076 A2	4/2006
WO	WO 2006/042084 A2	4/2006
WO	WO 2006/042110	4/2006
WO	WO 2006/042110 A2	4/2006
WO	WO 2006/042141	4/2006
WO	WO 2006/135479	12/2006
WO	WO 2008/118928	10/2008
WO	WO 2008/118928 A2	10/2008
WO	WO 2008/127968	10/2008
WO	WO 2008/127968 A2	10/2008

OTHER PUBLICATIONS

Extended European Search Report corresponding to European Application No. EP 11250214.1, completed May 25, 2011; mailed Jun. 1, 2011; (3 Pages).

European Search Report corresponding to EP 05810218.7, mailed on May 20, 2011; completed on Apr. 18, 2011; 3 pages.

European Search Report corresponding to EP 05807612.6, mailed on May 20, 2011; completed on May 2, 2011; 3 pages.

Extended European Search Report corresponding to EP 10251737.2, mailed on May 20, 2011; completed on May 9, 2011; 4 pages.

Extended International Search Report corresponding to European Application No. 07 25 3905.9, completed Jan. 29, 2008; mailed Feb. 7, 2008; (7 Pages).

Partial International Search Report corresponding to European Application No. EP 07 25 3807.7, completed Jul. 23, 2008; mailed Aug. 1, 2008; (3 pages).

International Search Report corresponding to International Application No. PCT/US08/58185, completed Sep. 4, 2008; mailed Sep. 9, 2008; (2 Pages).

International Search Report corresponding to International Application No. PCT/US08/59859, completed Sep. 14, 2008; mailed Sep. 18, 2008; (2 Pages).

Extended European Search Report corresponding to European Application No. EP 07 25 3807.7, completed Nov. 7, 2008; mailed Nov. 26, 2008; (11 Pages).

Extended European Search Report corresponding to European Application No. EP 09252049.3, completed Dec. 11, 2009; mailed Jan. 12, 2010; (3 Pages).

Extended European Search Report corresponding to European Application No. EP 09252050.1, completed Dec. 23, 2009; mailed Jan. 21, 2010; (3 Pages).

Extended European Search Report corresponding to European Application No. EP 09252051.9, completed Dec. 21, 2009; mailed Jan. 28, 2010; (3 Pages).

Extended European Search Report corresponding to European Application No. EP 09252052.7, completed Nov. 16, 2009; mailed Nov. 24, 2009; (3 Pages).

Extended European Search Report corresponding to European Application No. EP 09252053.5, completed Nov. 24, 2009; mailed Dec. 1, 2009; (3 Pages).

Extended European Search Report corresponding to European Application No. EP 09252054.3, completed Jan. 7, 2010; mailed Jan. 22, 2010; (3 Pages).

Extended European Search Report corresponding to European Application No. EP 09252056.8, completed Jan. 8, 2010; mailed Feb. 5, 2010; (3 Pages).

Extended European Search Report corresponding to European Application No. 10250497.4, completed May 4, 2010; mailed May 12, 2010; (6 Pages).

“Salute II Disposable Fixation Device”, Technique Guide—Laparoscopic and Open Inguinal and Ventral Hernia Repair; Davol, A Bard Company, 2006; (7 Pages).

European Search Report corresponding to European Application No. EP 05 80 2686.5, completed Jan. 9, 2012; mailed Jan. 18, 2012; (3 Pages).

Extended European Search Report corresponding to European Application No. EP 12 15 1313.9, completed Mar. 20, 2012 and mailed Apr. 12, 2012; (5 Pages).

European Search Report for corresponding EP12161291 date of mailing is May 4, 2012 (5 pgs).

Extended European Search Report corresponding to European Application No. EP 12 16 2288.0, completed Jun. 4, 2012 and mailed Jul. 7, 2012; (6 Pages).

Extended European Search Report corresponding to European Application No. EP 12 16 5891.8, completed Jun. 12, 2012 and mailed Jun. 20, 2012; (6 Pages).

Extended European Search Report corresponding to European Application No. EP 12 16 4955.2, completed Aug. 23, 2012 and mailed Sep. 4, 2012; (5 Pages).

Extended European Search Report corresponding to European Application No. EP 12 18 6401.1, completed Nov. 22, 2012 and mailed Nov. 30, 2012; (7 Pages).

Extended European Search Report corresponding to European Application No. EP 12 18 6448.2, completed Nov. 28, 2012 and mailed Dec. 10, 2012; (6 Pages).

Extended European Search Report corresponding to European Application No. EP 12 19 1706.6, completed Dec. 19, 2012 and mailed Jan. 8, 2013; (6 Pages).

Extended European Search Report corresponding to European Application No. EP 11 25 0754.6, completed Oct. 22, 2012 and mailed Oct. 31, 2012; (6 Pages).

Extended European Search Report corresponding to EP 13 16 6382.5, completed Nov. 19, 2013 and mailed Nov. 28, 2013; (8 pp).

Extended European Search Report corresponding to EP 11 25 0194.5, completed Nov. 25, 2013 and mailed Dec. 3, 2013; (8 pp).

Extended European Search Report corresponding to EP 10 25 1798.4, completed Dec. 12, 2013 and mailed Jan. 2, 2014; (9 pp).

Extended European Search Report corresponding to EP 12 19 8745.7, completed Mar. 19, 2013 and mailed Apr. 11, 2013; (8 pp).

Extended European Search Report corresponding to EP 12 15 2989.5, completed Apr. 9, 2013 and mailed Apr. 18, 2013; (9 pp).

Extended European Search Report corresponding to EP 08 73 2820.9, completed Jul. 2, 2013 and mailed Jul. 9, 2013; (10 pp).

Extended European Search Report corresponding to EP 12 19 1706.6, completed Dec. 19, 2012 and mailed Jan. 8, 2013; (6 pp).

Extended European Search Report corresponding to EP 13 17 2008.8, completed Aug. 14, 2013 and mailed Aug. 28, 2013; (8 pp).

Extended European Search Report corresponding to EP 10 25 2112.7, completed Jul. 29, 2014 and mailed Aug. 5, 2014; (8 pp).

Extended European Search Report corresponding to EP 14 15 1673.2, completed Apr. 25, 2014 and mailed May 8, 2014; (8 pp).

Japanese Office Action corresponding to JP 2011-160130 mailed Dec. 1, 2014.

Chinese Office Action corresponding to CN 201210015011.8 issued Jan. 4, 2015.

Japanese Office Action corresponding to JP 2011-160126 mailed Jan. 9, 2015.

Japanese Office Action corresponding to JP 2011-184521 mailed Jan. 15, 2015.

Extended European Search Report corresponding to 14 18 2236.1 dated Jan. 20, 2015.

Chinese Office Action corresponding to CN 201110201736.1 issued Feb. 9, 2015.

Extended European Search Report corresponding to EP 14 16 1540.1 dated Feb. 27, 2015.

Australian Office Action corresponding to AU 2010226985 issued Mar. 31, 2015.

Australian Office Action corresponding to AU 2013211526 issued Apr. 6, 2015.

Australian Office Action corresponding to AU 2011211463 issued Apr. 13, 2015.

(56)

References Cited

OTHER PUBLICATIONS

Australian Office Action corresponding to AU 2013254887 issued Apr. 14, 2015.

Japanese Office Action corresponding to JP 2013-225272 mailed May 1, 2015.

European Office Action corresponding to EP 12 152 989.5 dated May 4, 2015.

Australian Office Action corresponding to AU 2009212759 issued May 7, 2015.

Japanese Office Action corresponding to JP 2013-229070 mailed May 8, 2015.

Japanese Office Action corresponding to JP 2013-229996 mailed May 8, 2015.

Japanese Office Action corresponding to JP 2014-190735 dated May 27, 2015; no English translation attached—unavailable.

* cited by examiner

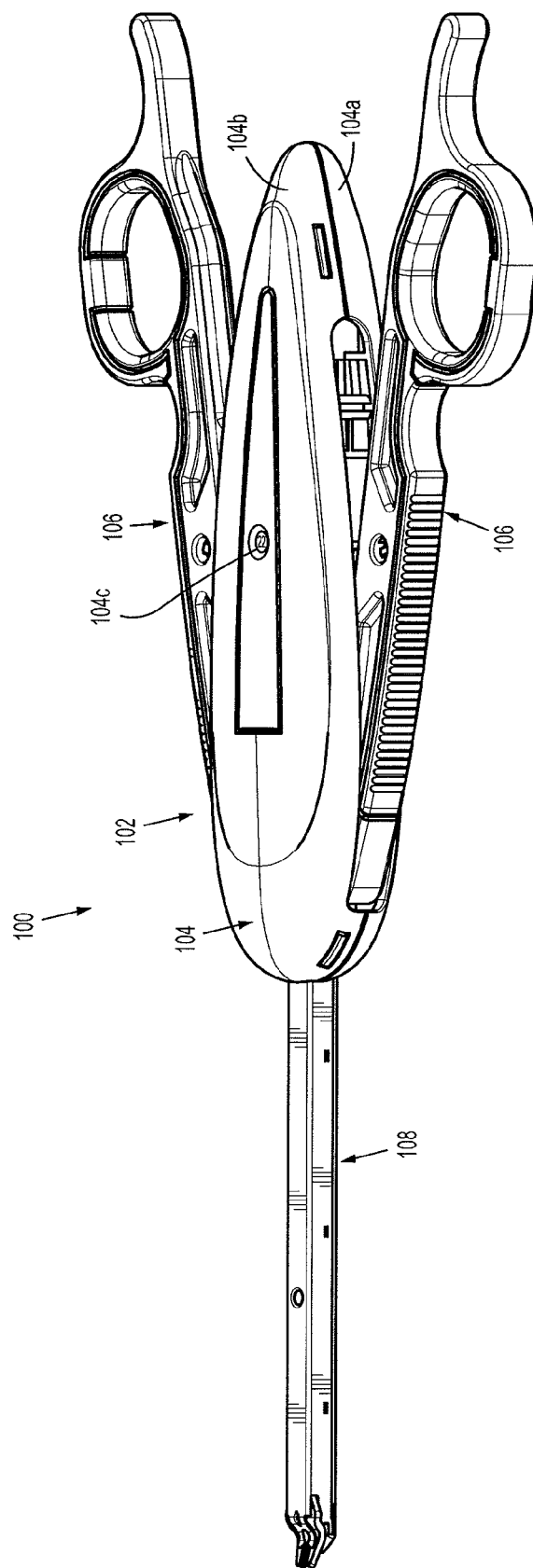


FIG. 1

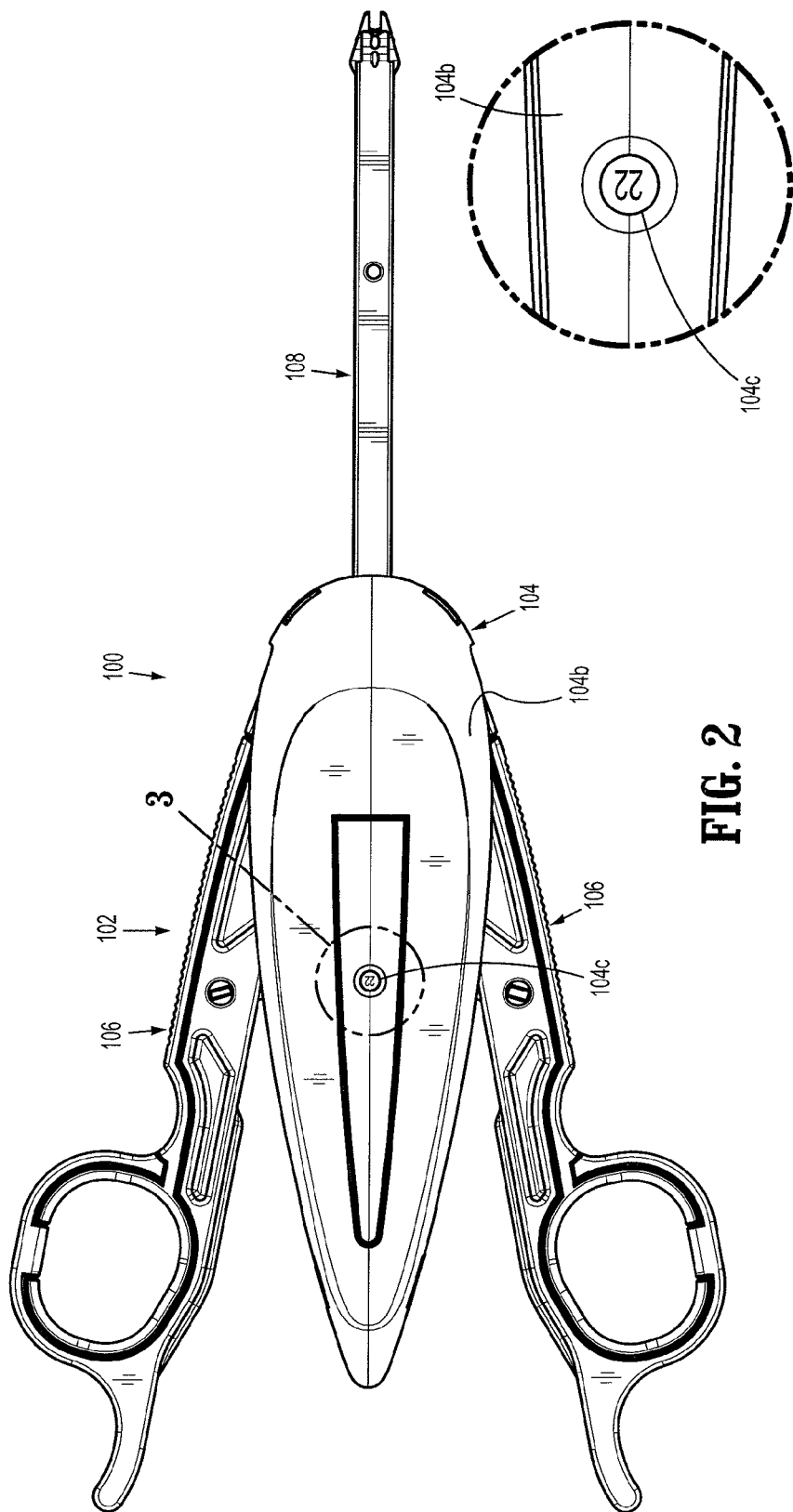


FIG. 2

FIG. 3

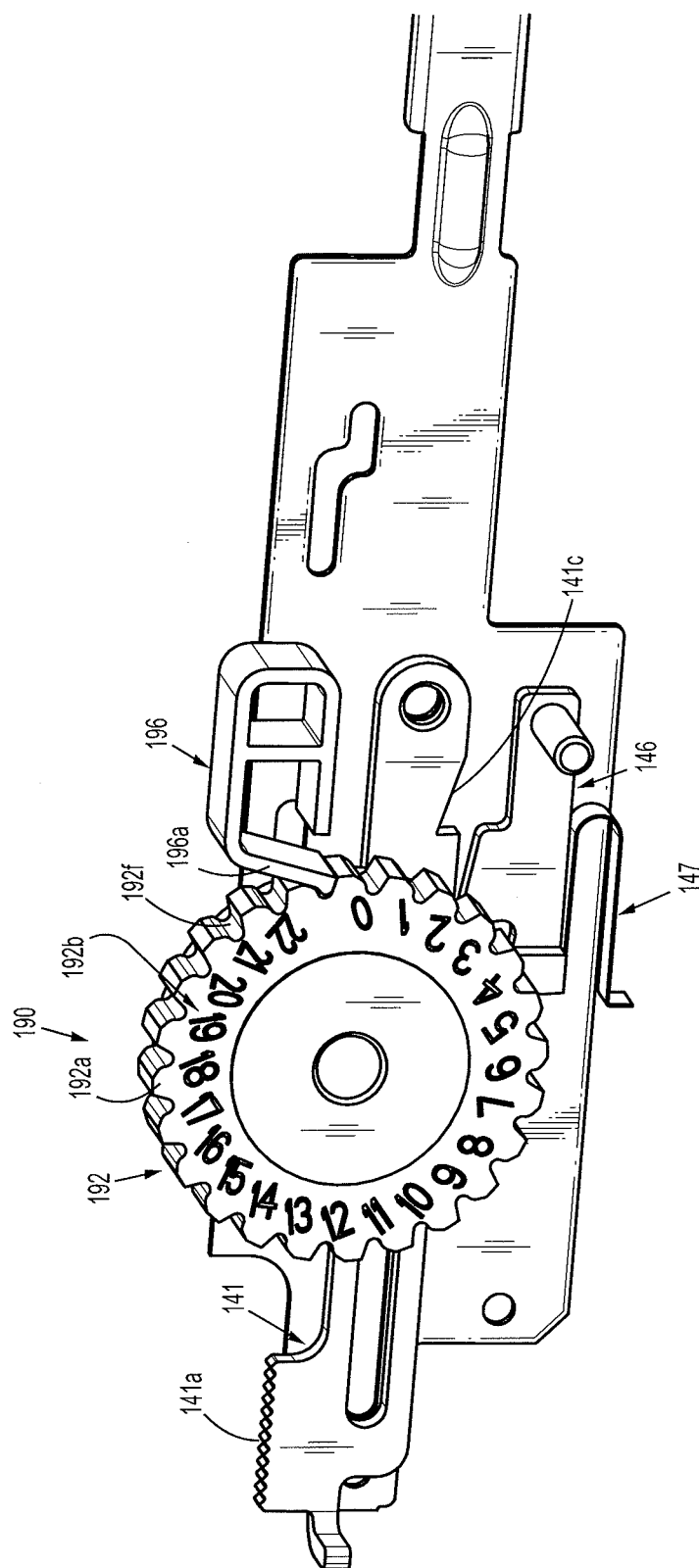


FIG. 4

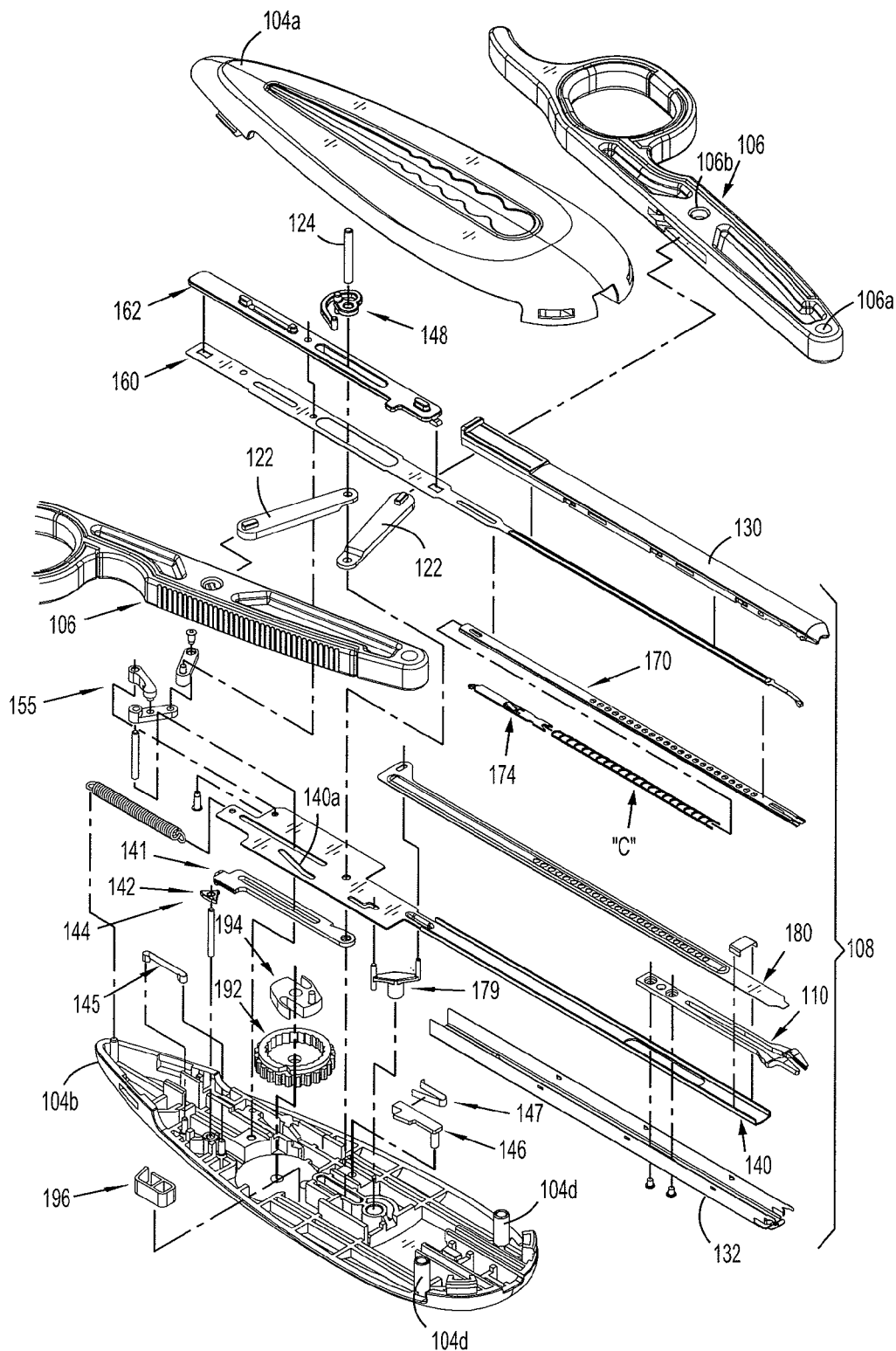


FIG. 5

FIG. 6

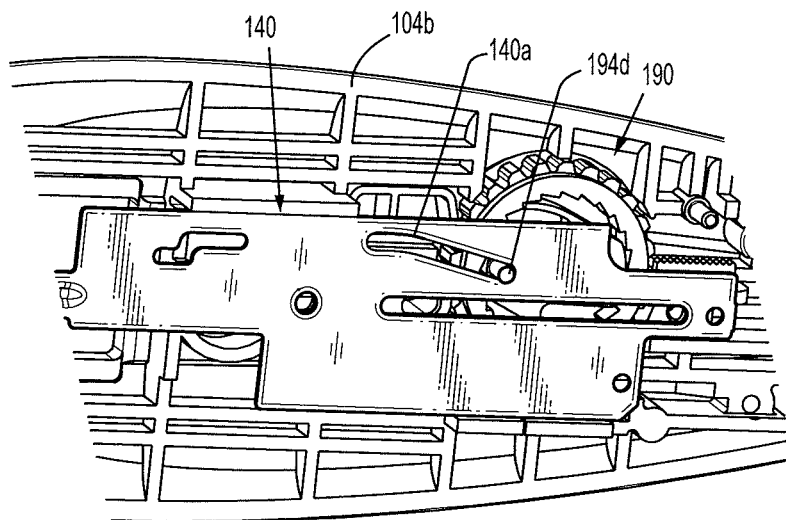
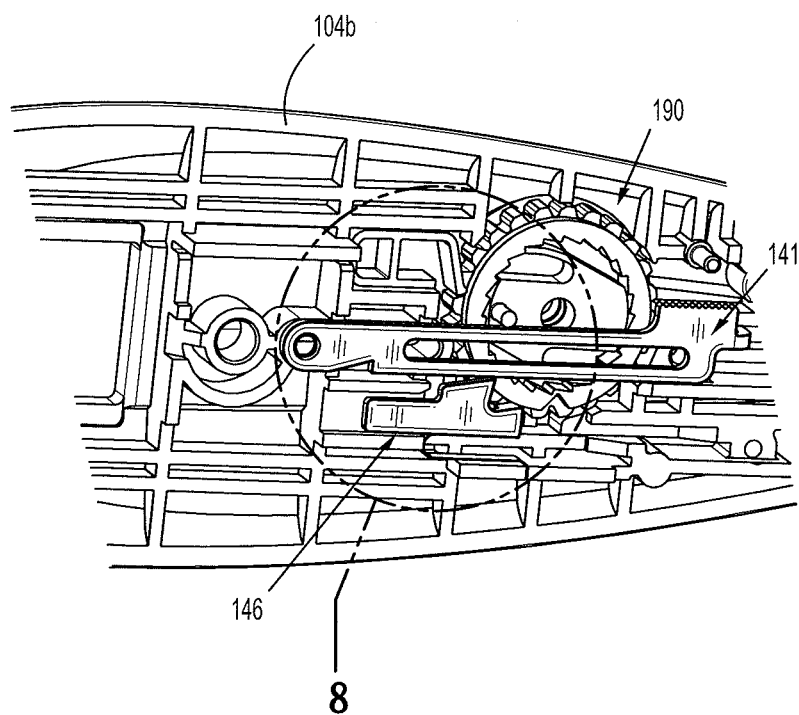


FIG. 7



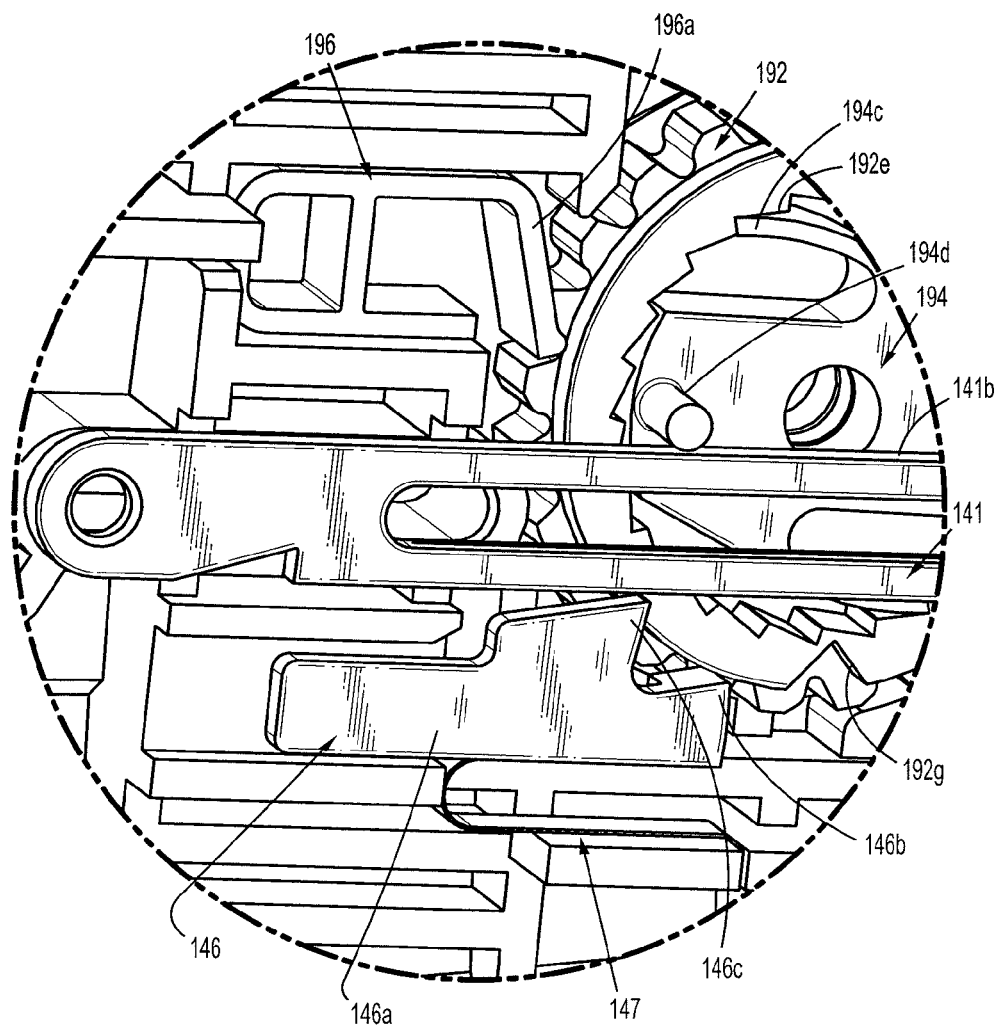


FIG. 8

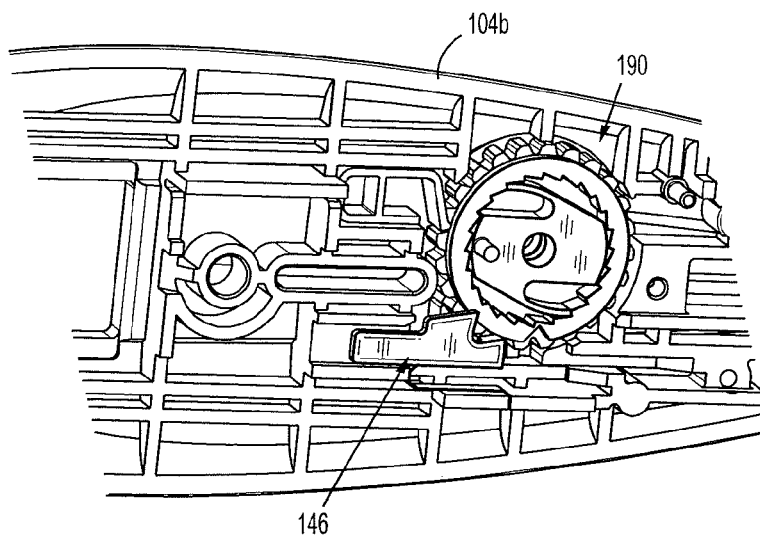


FIG. 9

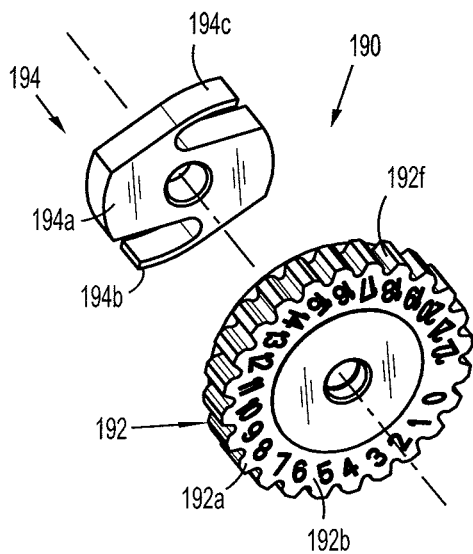


FIG. 10

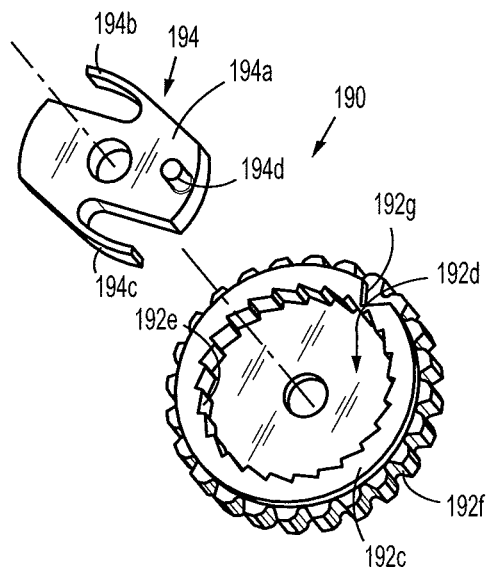


FIG. 11

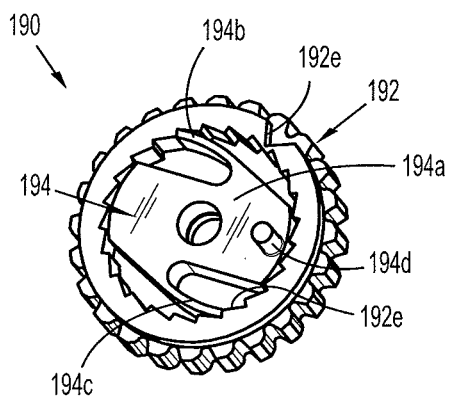


FIG. 12

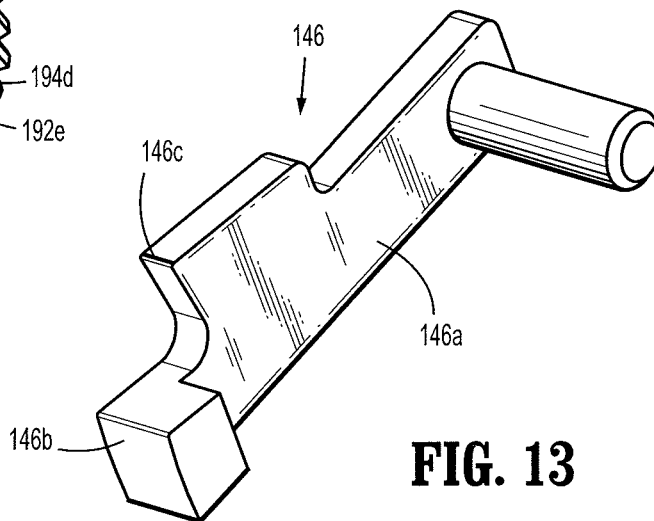


FIG. 13

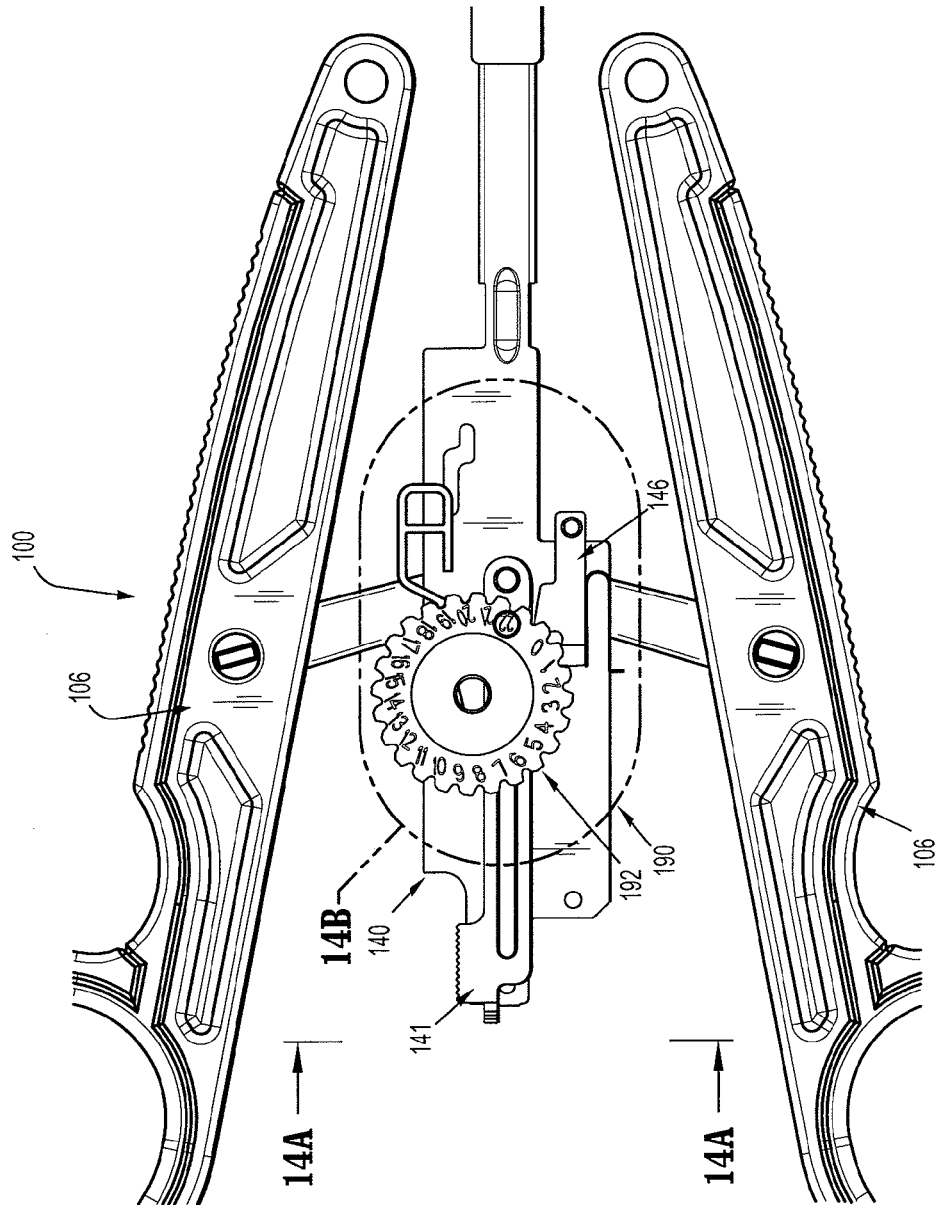


FIG. 14

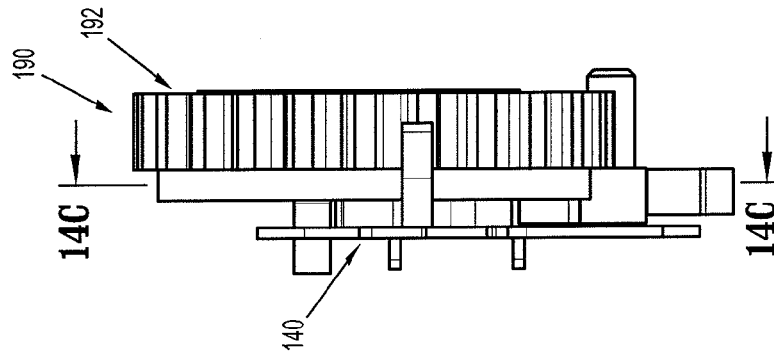


FIG. 14A

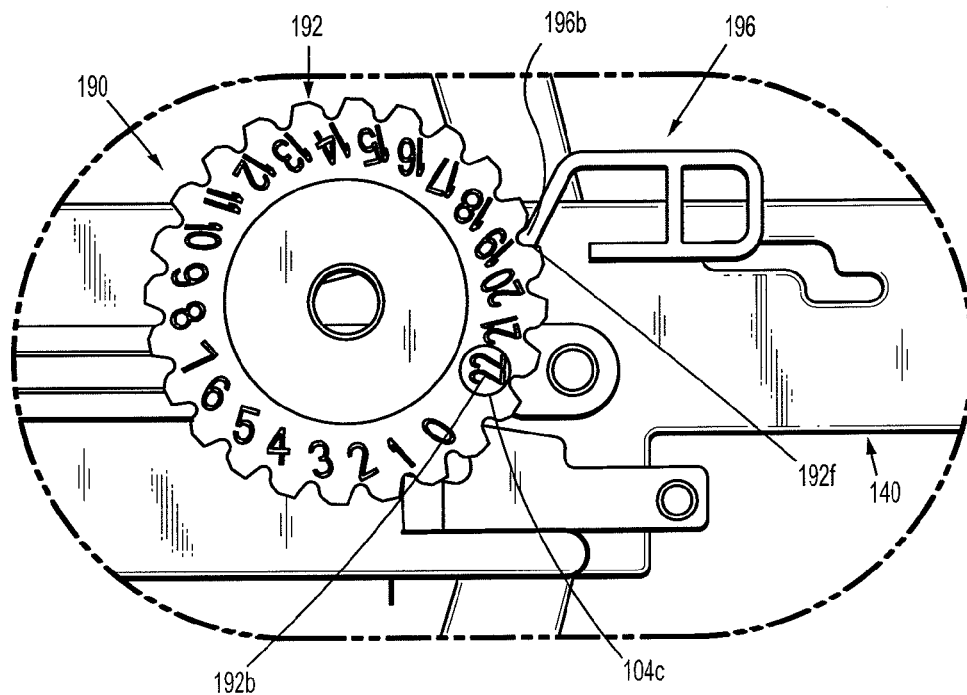


FIG. 14B

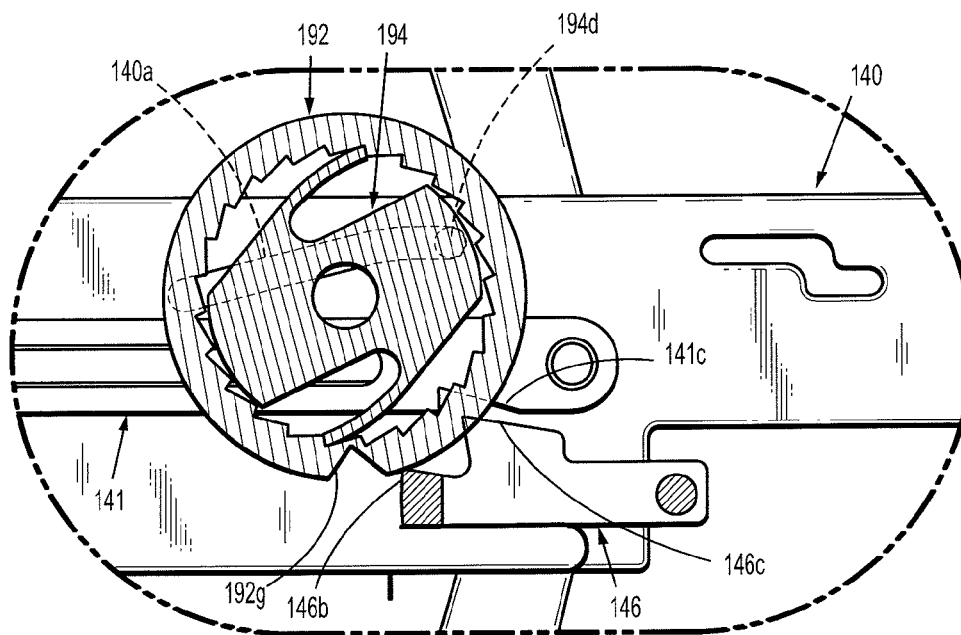


FIG. 14C

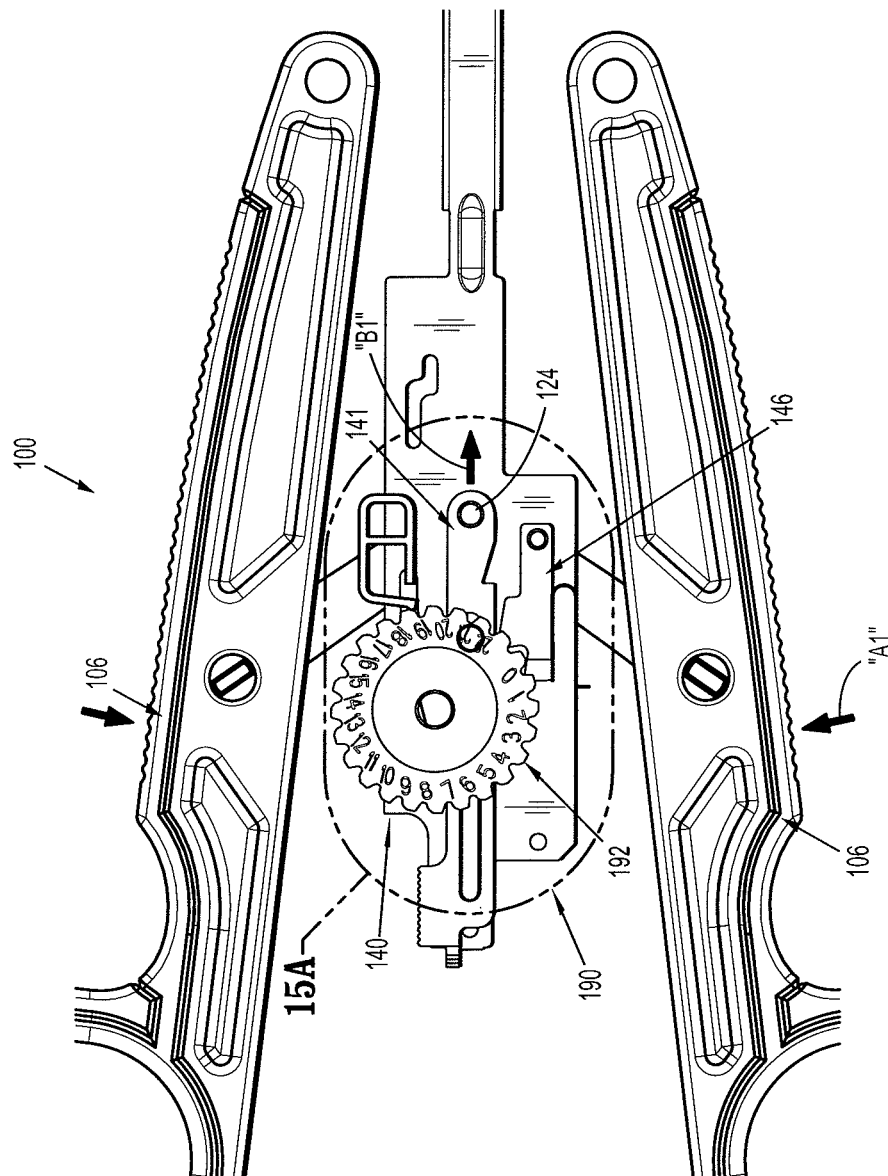


FIG. 15

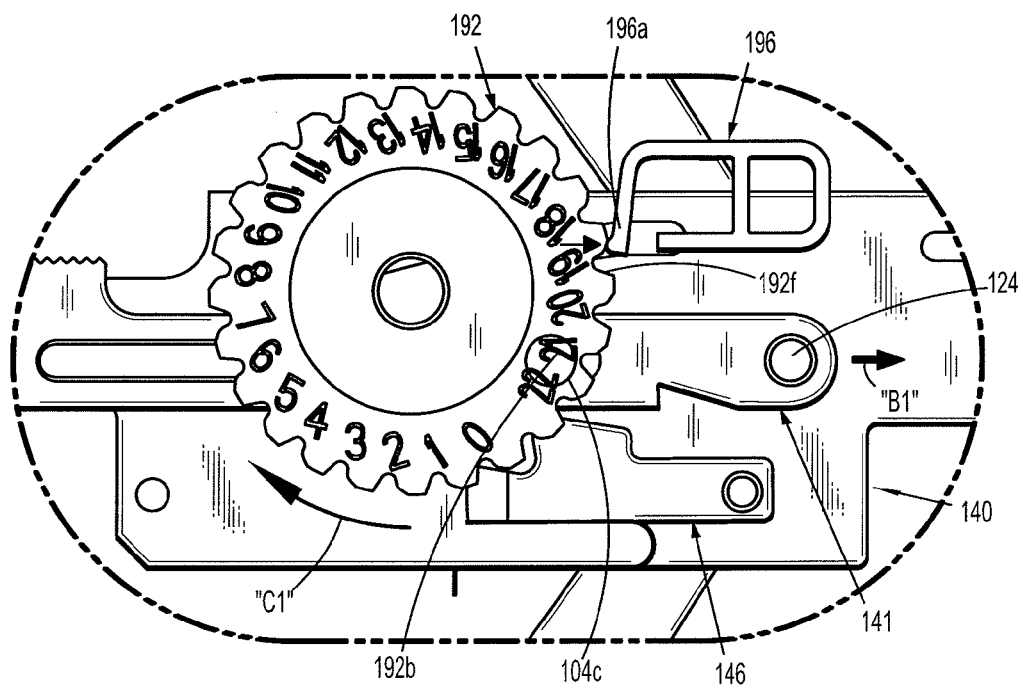


FIG. 15A

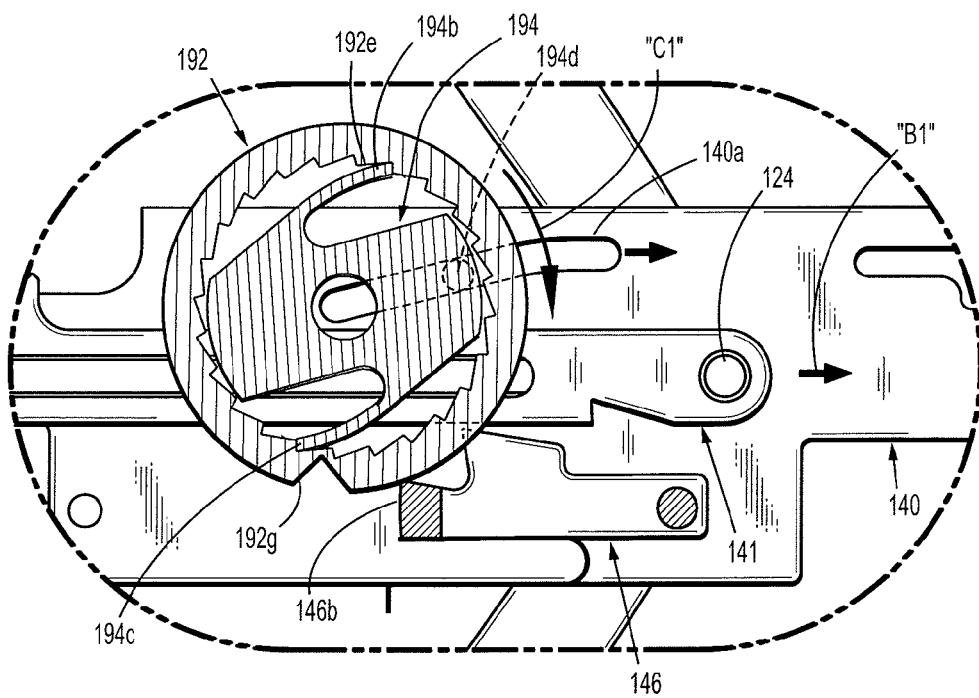


FIG. 15B

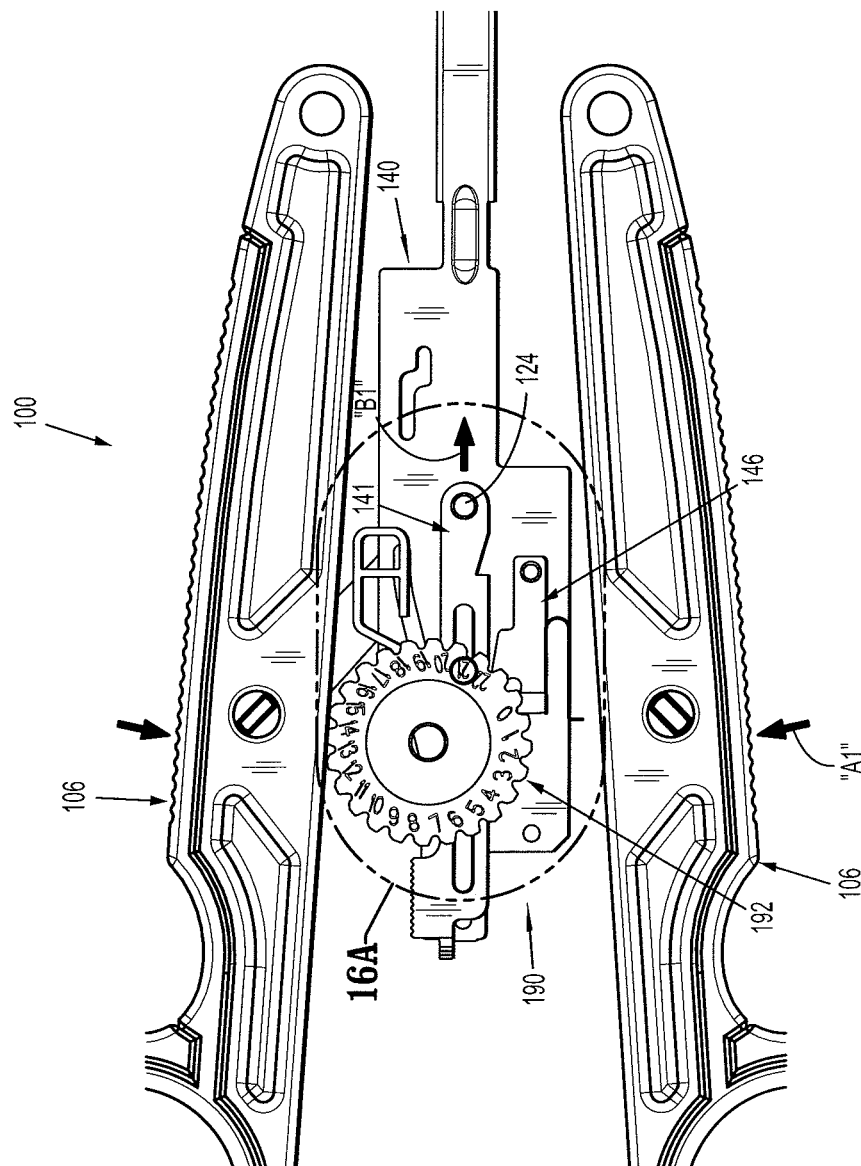


FIG. 16

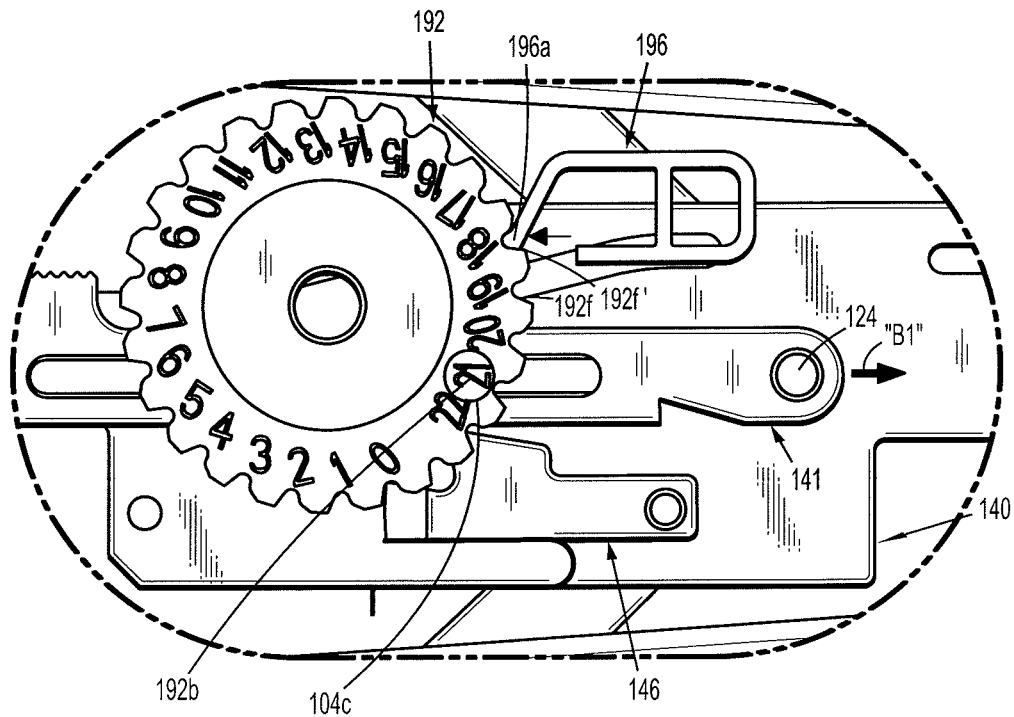


FIG. 16A

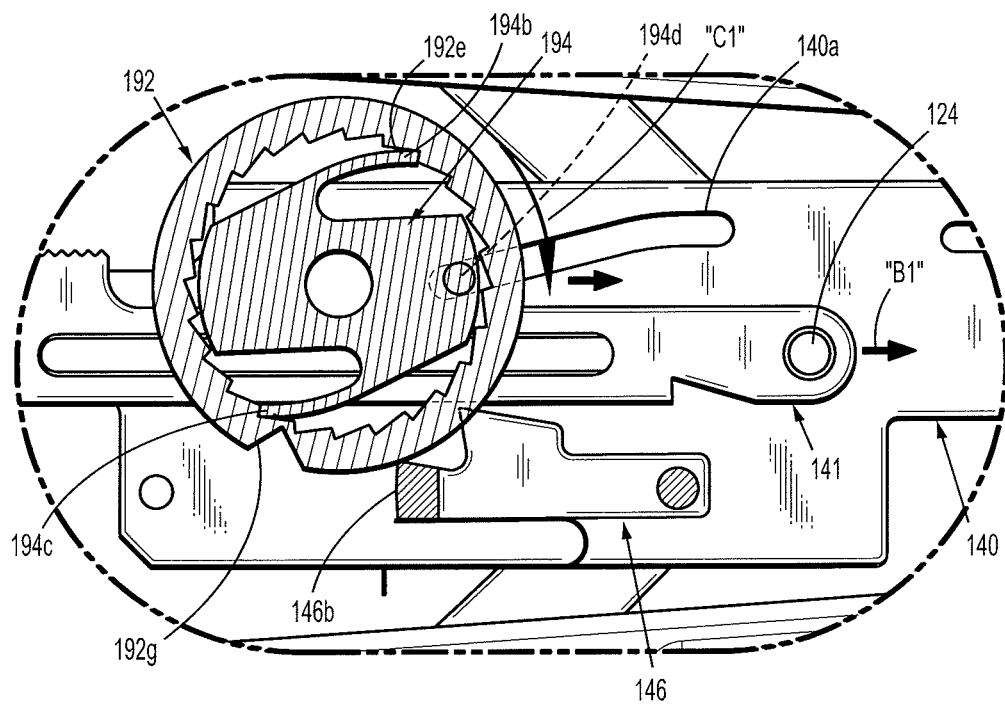


FIG. 16B

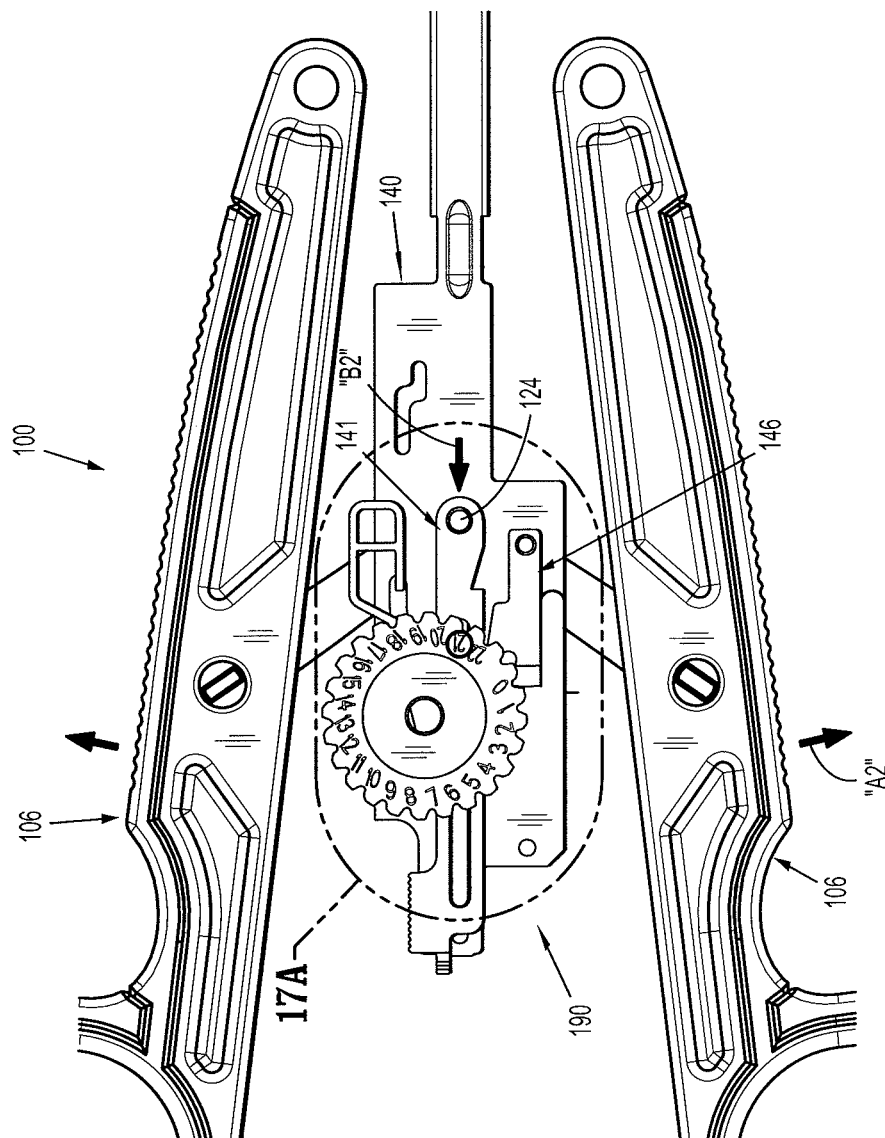


FIG. 17

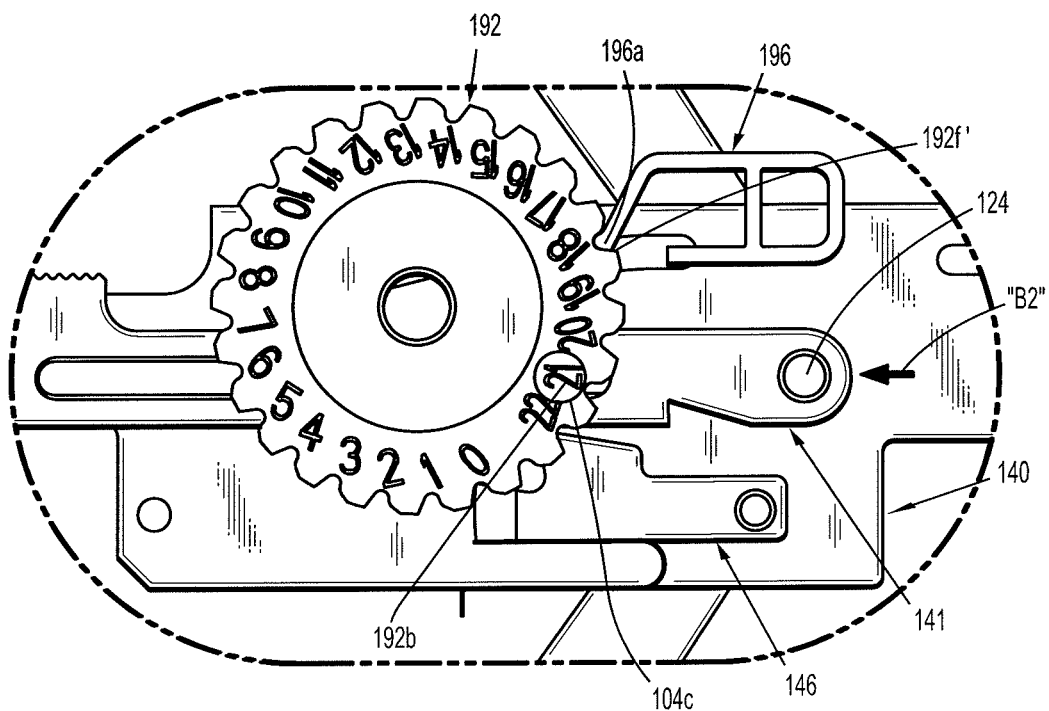


FIG. 17A

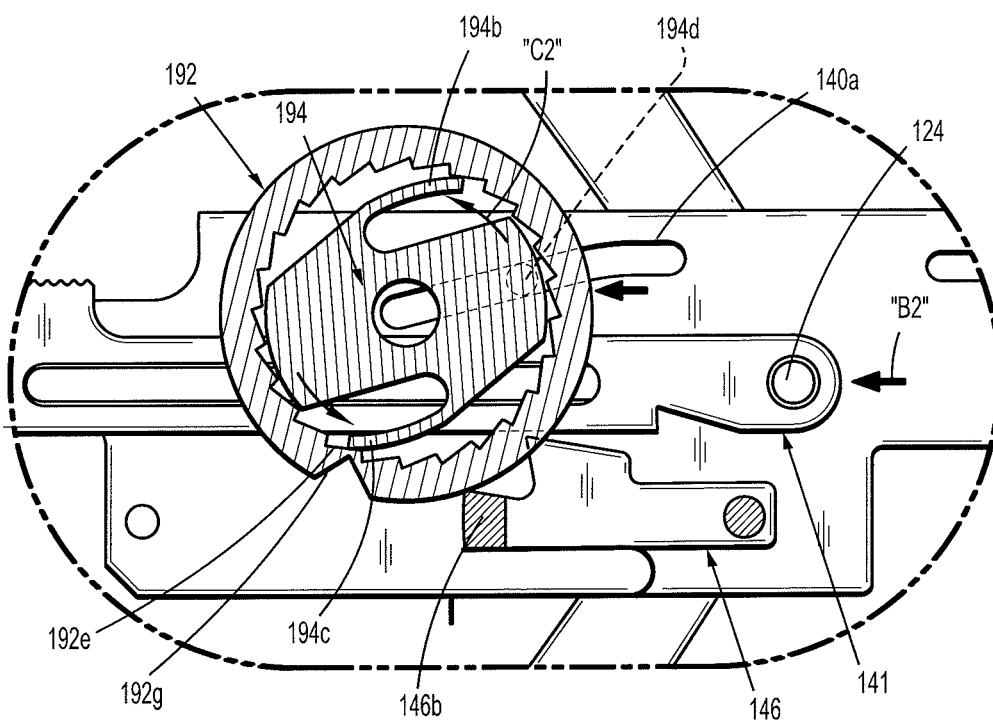


FIG. 17B

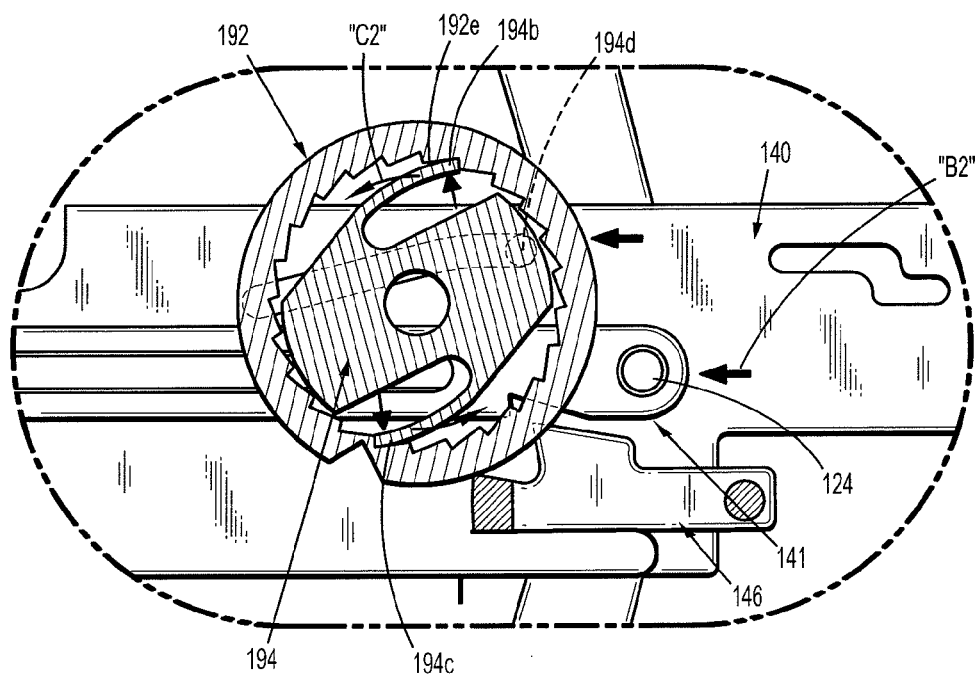


FIG. 18

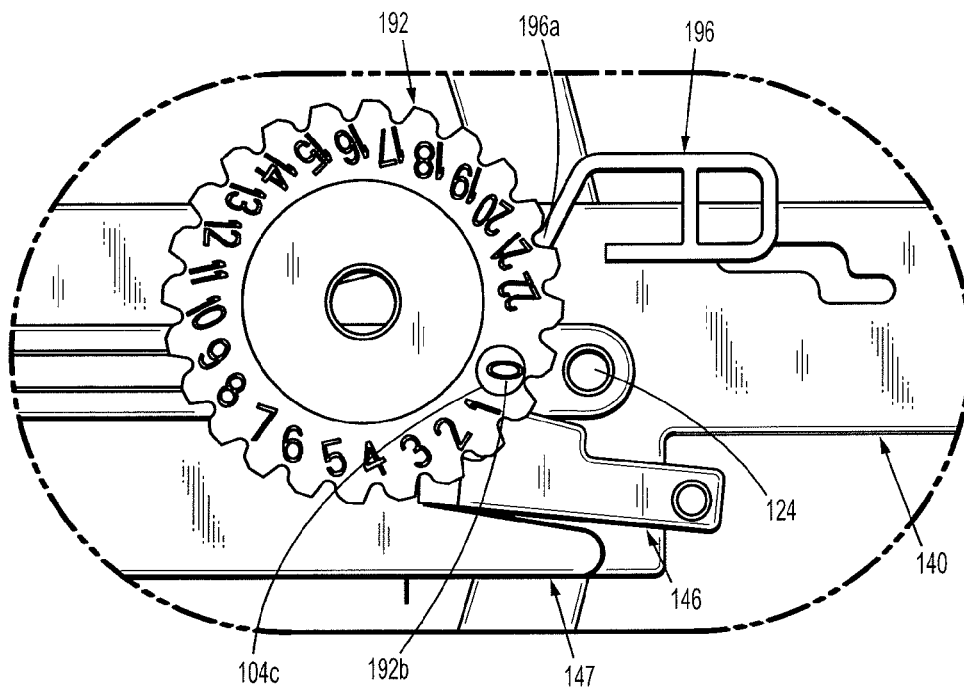


FIG. 19

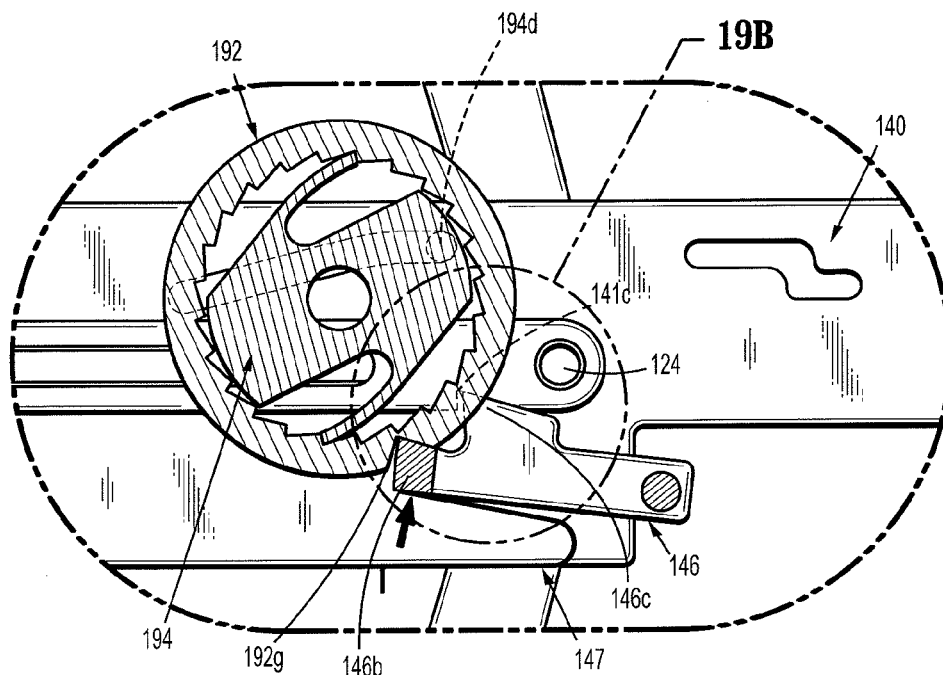


FIG. 19A

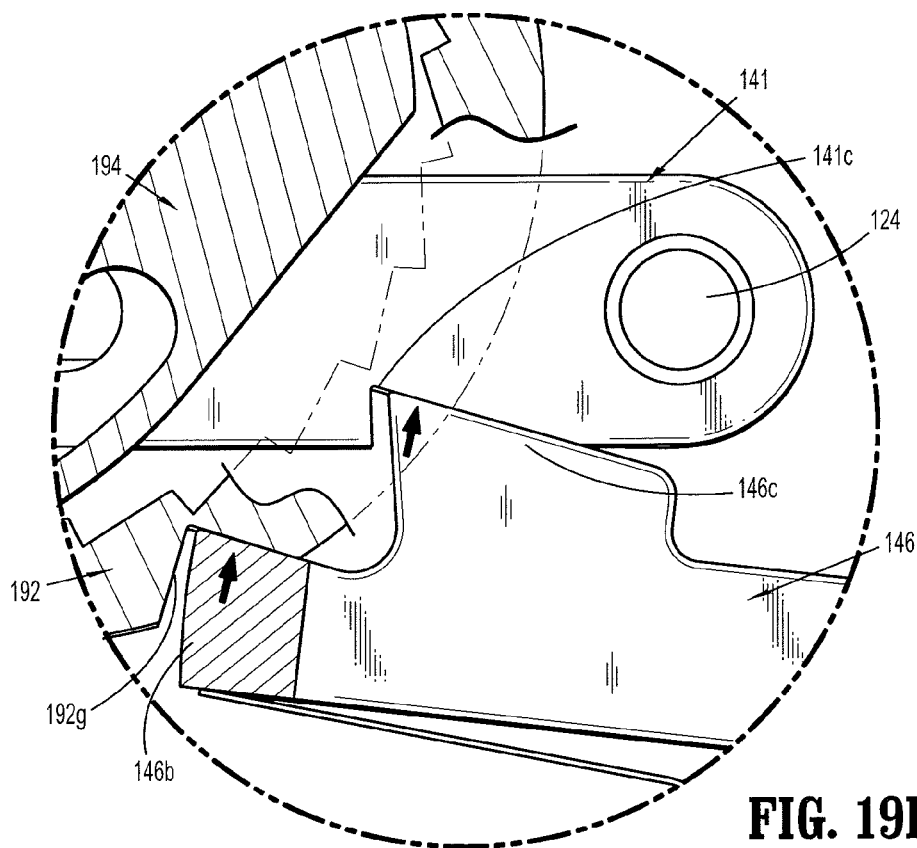


FIG. 19B

1

SURGICAL CLIP APPLIER**CROSS REFERENCE TO RELATED APPLICATION**

The present application claims the benefit of and priority to U.S. Provisional Application Ser. No. 61/285,006, filed on Dec. 9, 2009, the entire content of which is incorporated herein by reference.

BACKGROUND**1. Technical Field**

The present application relates to surgical instruments, and more particularly, to surgical clip appliers having a plurality of clips for applying the clips to body tissues and vessels during surgical procedures.

2. Discussion of Related Art

Surgical clip appliers are known in the art and have increased in popularity among surgeons by offering an alternative to conventional suturing of body tissues and vessels. Typical instruments are disclosed in U.S. Pat. No. 5,030,226 to Green et al. and U.S. Pat. No. 5,431,668 to Burbank, III et al. These instruments generally provide a plurality of clips which are stored in the instrument and which are fed sequentially to the jaw mechanism at the distal end of the instrument upon opening and closing of the handles at the proximal end of the instrument. As the handles are closed, the jaws close to deform a clip positioned between the jaw members, and as the jaws are opened to release the deformed clip, a new clip is fed from the series to a position between the jaws. This process is repeated until all the clips in the series of clips have been used.

A need exists for a user of the clip applier to know how many clips remain in the clip applier and/or to know when a final clip of the plurality of clips has been fired.

SUMMARY

The present application relates to surgical clip appliers having a plurality of clips for applying the clips to body tissues and vessels during surgical procedures and their methods of use.

According to an aspect of the present disclosure, a surgical clip applier is provided including a housing; at least one handle pivotably connected to the housing; a channel assembly extending distally from the housing; a plurality of clips loaded in the clip carrier; a drive channel translatable supported in the housing and the channel assembly, the drive channel being translated upon actuation of the at least one handle; and a counter mechanism supported in the housing, the counter mechanism including indicia visible through the housing, wherein the indicia corresponds to a quantity of clips loaded in the clip applier, wherein the indicia decrements upon each firing of the clip applier resulting in a reduction in the quantity of clips remaining of the plurality of clips.

The counter mechanism may be rotatably supported in the housing and may include a uni-directional clutch member permitting rotation of the counter mechanism in a single direction. The counter mechanism may include a counter dial rotatably supported in the housing, wherein the counter dial includes the indicia thereof; and a counter clutch operatively connected to the counter dial such that rotation of the counter clutch in a first direction results in rotation of the counter dial in the first direction, and rotation of the counter clutch in second direction results in no rotation of the counter dial.

The counter mechanism may include a latch member operatively engaged with the counter dial. In use, the latch

2

member permits rotation of the counter dial in the first direction and inhibits rotation of the counter mechanism in a direction opposite to the first direction.

The counter dial may include a plurality of grooves formed in an outer periphery thereof, and the latch member may include a resilient finger biased into engagement with the plurality of grooves of the counter dial.

The counter clutch may be concentrically, rotatably nested in a bore defined in the counter dial. The counter clutch may include at least one resilient finger extending therefrom for engagement with uni-directional teeth formed in a perimetrical surface of the bore of the counter dial.

The drive channel may define an angled slot therein, and the counter clutch may include a clutch pin extending from a surface thereof and may be slidably disposed in the angled slot of the drive channel. In use, translation of the drive channel in a first direction relative to the counter mechanism would cause the clutch pin to be cammed by the angled slot thereof thereby causing the counter clutch to rotate in the first direction, and translation of the drive channel in a second direction relative to the counter mechanism would cause the clutch pin to be cammed by the angled slot thereof thereby causing the counter clutch to rotate in the second direction.

The counter mechanism may include a latch member operatively engaged with the counter dial. In use, the latch member permits rotation of the counter dial in the first direction and inhibits rotation of the counter mechanism in a direction opposite to the first direction.

The counter mechanism may include a counter dial defining a lock out groove formed in an outer perimetrical edge thereof; and a lock out supported in the housing. The lock out may be biased such that a first catch thereof engages against the outer perimetrical edge of the counter dial. In use, as the counter dial is rotated and the lock out groove of the counter dial is brought into registration with the first catch of the lock out, the first catch of the lock out is urged into the lock out groove thereby preventing a rotation of the counter dial in an opposite direction.

The lock out may include a second catch. In use, the second catch of the lock out moves into a path of a translating member of the clip applier when the first catch of the lock out is moved into the lock out groove of the counter dial, thereby inhibiting a translation of the translating member of the clip applier.

The lock out groove of the counter dial may move into registration with the first catch of the lock out when a final clip of the plurality of clips has been fired. The lock out groove of the counter dial may be associated with an indicia on the counter mechanism indicating that the final clip has been fired. The indicia on the counter mechanism, indicating that the final clip of the plurality of clip has been fired, may be represented by the number "zero."

The clip applier may further include a ratchet mechanism having a ratchet pawl pivotably supported in the housing; and a rack member provided on the translating member. The rack member may be in operative registration with the ratchet pawl. In use, the rack member translates across the ratchet pawl as the translating member translates. The ratchet mechanism may be prevented from re-setting when the rack member has not completed a fully translation.

BRIEF DESCRIPTION OF THE DRAWINGS

The present clip applier will be more fully appreciated as the same becomes better understood from the following detailed description when considered in connection with the following drawings, in which:

3

FIG. 1 is a perspective view of a surgical clip applier according to an embodiment of the present disclosure;

FIG. 2 is a top, plan view of the surgical clip applier of FIG. 1;

FIG. 3 is an enlarged view of the indicated area of detail of FIG. 2;

FIG. 4 is a perspective view of a mechanical counter assembly of the surgical clip applier of FIGS. 1 and 2;

FIG. 5 is an exploded perspective view of the surgical clip applier of FIGS. 1-4;

FIG. 6 is a perspective view of a handle assembly with a housing half-section removed therefrom and illustrating a counter of the mechanical counter assembly engaged with a drive channel;

FIG. 7 is a perspective view of a handle assembly with a housing half-section and drive channel removed therefrom and illustrating the counter of the mechanical counter assembly engaged with a ratchet;

FIG. 8 is an enlarged view of the indicated area of detail of FIG. 7;

FIG. 9 is a perspective view of a handle assembly with a housing half-section, the drive channel, and the ratchet removed therefrom;

FIG. 10 is a front, perspective view, with parts separated, of a counter and a clutch of the mechanical counter assembly;

FIG. 11 is a rear, perspective view, with parts separated, of the counter and the clutch of the mechanical counter assembly of FIG. 10;

FIG. 12 is a rear, perspective view of the counter and the clutch of the mechanical counter assembly of FIGS. 10 and 11;

FIG. 13 is a perspective view of a lock-out of the clip applier of FIGS. 1-4;

FIG. 14 is a top plan, schematic illustration of the mechanical counter assembly operatively connected to the drive channel when the clip applier is in an original unactuated position;

FIG. 14A is a side view of the mechanical counter assembly as viewed along 14A-14A of FIG. 14;

FIG. 14B is an enlarged view of the indicated area of detail of FIG. 14;

FIG. 14C is a cross-sectional view of the mechanical counter assembly as taken along 14C-14C of FIG. 14A;

FIG. 15 is a top plan, schematic illustration of the mechanical counter assembly operatively connected to the drive channel when the clip applier is initially actuated;

FIG. 15A is an enlarged view of the indicated area of detail of FIG. 15;

FIG. 15B is a cross-sectional view of the mechanical counter assembly as taken along 14C-14C of FIG. 14A, during the initial actuation of the clip applier;

FIG. 16 is a top plan, schematic illustration of the mechanical counter assembly operatively connected to the drive channel when the clip applier is fully actuated;

FIG. 16A is an enlarged view of the indicated area of detail of FIG. 16;

FIG. 16B is a cross-sectional view of the mechanical counter assembly as taken along 14C-14C of FIG. 14A, following the full actuation of the clip applier;

FIG. 17 is a top plan, schematic illustration of the mechanical counter assembly operatively connected to the drive channel when the clip applier is released after full actuation;

FIG. 17A is an enlarged view of the indicated area of detail of FIG. 17;

FIG. 17B is a cross-sectional view of the mechanical counter assembly as taken along 14C-14C of FIG. 14A, during a release of the clip applier following full actuation;

4

FIG. 18 is a cross-sectional view of the mechanical counter assembly as taken along 14C-14C of FIG. 14A, illustrating the mechanical counter assembly fully re-set;

FIG. 19 is a top, plan view of the mechanical counter assembly, illustrating the counter at a "zero" position and locked out;

FIG. 19A is a cross-sectional view of the mechanical counter assembly as taken along 14C-14C of FIG. 14A, illustrating the counter at a "zero" position and locked out; and

FIG. 19B is an enlarged view of the indicated area of detail of FIG. 19A.

DETAILED DESCRIPTION OF EMBODIMENTS

Embodiments of surgical clip appliers in accordance with the present disclosure will now be described in detail with reference to the drawing figures wherein like reference numerals identify similar or identical structural elements. As shown in the drawings and described throughout the following description, as is traditional when referring to relative positioning on a surgical instrument, the term "proximal" refers to the end of the apparatus which is closer to the user and the term "distal" refers to the end of the apparatus which is further away from the user.

Referring now to FIGS. 1-5, a surgical clip applier in accordance with an embodiment of the present disclosure is generally designated as 100. Surgical clip applier 100 generally includes a handle assembly 102 including a housing 104 having an upper housing half 104a and lower housing half 104b. Handle assembly 102 further includes a pair of handles 106 pivotably secured to housing 104 and extending outwardly therefrom. A channel assembly 108 is fixedly secured to housing 104 and extends outwardly therefrom, terminating in a jaw assembly 110.

As seen in FIGS. 1-5, housing halves 104a and 104b of clip applier 100 fit together by snap fit engagement with one another. Housing 104 defines a window 104c formed in lower housing half 104b for supporting and displaying a counter mechanism, as will be discussed in greater detail below.

As seen in FIG. 4, handles 106 are secured to housing 104 by handle pivot posts 104d extending from lower housing half 104b and into respective apertures 106a formed in handles 106. Handle assembly 102 includes a link member 122 pivotally connected to each handle 106 at a pivot point 106b formed in a respective handle 106. A distal end of each link member 122 is pivotally connected to a pivot point formed in a drive channel 140 via a drive pin 124. Each end of drive pin 124 is slidably received in an elongate channel formed in a respective upper and lower housing half 104a, 104b. In use, as will be described in greater detail below, as handles 106 are squeezed, link members 122 push drive channel 140 distally via drive pin 124.

Channel assembly 108 includes a channel or cartridge cover 130 and an outer or lower channel 132 each having a proximal end retained in housing assembly 102, between upper and lower housing halves 104a, 104b.

As seen in FIG. 5, clip applier 100 includes a clip pusher bar 160 slidably disposed beneath cartridge cover 130, a stabilizer 162 configured to overlie and engage pusher bar 160, a motion multiplier system 155 supported in housing 104, a clip carrier 170 disposed within channel assembly 108 and beneath pusher bar 160, a stack of surgical clips "C" loaded and/or retained within clip carrier 170 in a manner so as to slide therewithin and/or therealong, a clip follower 174 slidably disposed within clip carrier 170 and positioned behind the stack of surgical clips "C," a wedge plate 180 slidably disposed within handle assembly 102 and channel

5

assembly **108**, a wedge plate pivot arm **179** pivotally supported in lower housing half **104b** of housing **104** for transmitting translation of drive channel **140** to translation of wedge plate **180**, a drive channel **140** reciprocally supported in and extending between housing **104** of handle assembly **102** and channel assembly **108**, an audible/tactile indicator **148** connected to drive channel **140** via drive pin **124**, and a jaw assembly **110** mounted on or at a distal end of channel assembly **108** and actuatable by handles **106** of handle assembly **102**.

Reference may be made to U.S. Provisional Application No. 61/091,467, filed on Aug. 25, 2008, entitled "Surgical Clip Applier" and U.S. Provisional Application No. 61/091,485, filed on Aug. 25, 2008, entitled "Surgical Clip Applier and Method of Assembly," the entire contents of each of which being incorporated herein by reference, for a detailed discussion of the structure, operation, and method of assembly of various components surgical clip applier **100**. Reference may also be made to U.S. Provisional Application No. 61/286,569, filed on Dec. 15, 2009, entitled "Surgical Clip Applier", the entire contents of which is incorporated herein by reference, for additional detailed discussion of the structure, operation, and method of assembly of various components of surgical clip applier **100**.

As seen in FIGS. 1-12, clip applier **100** further includes a mechanical counter mechanism **190** supported in housing **104** of handle assembly **102**. Counter mechanism **190** includes a counter dial **192** rotatably disposed within housing **104** so as to overlie window **104c** formed in lower housing half **104b**, a counter clutch **194** operatively connected to counter dial **192** and configured to permit uni-directional rotation of counter dial **192**, and a latch member **196** configured to engage counter dial **192**.

As seen in FIGS. 4-11, counter dial **192** includes a first face **192a** disposed adjacent window **104c** formed in lower housing half **104b**. First face **192a** includes a plurality of indicia **192b**, in the form of sequential numbers disposed thereof and substantially around a radial periphery thereof. Indicia **192b** may correspond to the number of clips that are loaded in clip applier **100**. By way of example only, indicia **192b** may be numerals from "0-22." Indicia **192b** are located on first face **192a** so as to be in registration with window **104c** formed in lower housing half **104b**. Counter dial **192** includes a second face **192c**, opposite first face **192b**, and defining a bore **192d** therein. Bore **192d** includes a radial array of uni-directional teeth **192e** formed therein. Counter dial **192** further includes a first or outer rim defining a plurality of grooves **192f** formed around an outer periphery thereof, and a second or inner rim defining a single groove **192g** formed in an outer periphery thereof.

With continued reference to FIGS. 4-11, counter clutch **194** is concentrically and rotatably nested in bore **192d** of counter dial **192**. Counter clutch **194** of mechanical counter mechanism **190** includes a body portion **194a** configured and dimensioned for rotatable disposition in bore **192d** of counter dial **192**. Counter clutch **194** includes a pair of opposed resilient fingers **194b**, **194c** extending substantially tangentially from body portion **194a**. Resilient fingers **194b**, **194c** extend from body portion **194a** by an amount sufficient so as to resiliently engage uni-directional teeth **192e** of dial **192**. Counter clutch **194** includes a clutch pin **194d** extending from body portion **194a** and projecting out of bore **192d** of counter dial **192**.

As seen in FIGS. 4-9, latch member **196** of mechanical counter mechanism **190** is secured to lower housing half **104b**. Latch member **196** includes a resilient finger **196a**

6

configured to contact and selectively engage grooves **192f** formed around the outer periphery of counter dial **192**.

As seen in FIGS. 5 and 6, drive channel **140** defines an angled slot **140a** formed therein at a location so as to slidably receive clutch pin **194d** extending from body portion **194a** of counter clutch **194**. Angled slot **140a** of drive channel **140** extends in a direction away from a longitudinal axis of clip applier **100** from a proximal to a distal direction.

As seen in FIGS. 4, 5, 7 and 8, clip applier **100** includes a ratchet rack member **141** slidably disposed in lower housing half **104b**. Rack member **141** is pinned to drive pin **124** such that translation of drive pin **124** relative to housing **104** results in concomitant translation of rack member **141**. Rack member **141** is disposed in housing **104** such that clutch pin **194d** of counter clutch **194** rides along or contacts a side edge **141b** thereof. Rack member **141** includes ratchet teeth **141a** formed along an edge thereof and are configured and adapted to engage with a ratchet pawl **142** supported in housing **104**. Rack member **141** and pawl **142** define a ratchet mechanism **144**.

In use, as drive channel **140** is moved axially by drive pin **124**, rack member **141** is also moved. Rack teeth **141a** of rack member **141** has a length which allows pawl **142** to reverse and advance back over rack member **141** when rack member **141** changes between proximal and distal movement as drive channel **140** reaches a proximal-most or distal-most position.

Pawl **142** is pivotally connected to lower housing half **104b** by a pawl pin at a location wherein pawl **142** is in substantial operative engagement with rack member **141**. Pawl **142** is engageable with rack member **141** to restrict longitudinal movement of rack member **141** and, in turn, drive channel **140**. Ratchet mechanism **144** further includes a pawl spring **145** configured and positioned to bias pawl **142** into operative association with rack member **141**. Pawl spring **145** functions to maintain the teeth of pawl **142** in engagement with the teeth **141a** of rack member **141**, as well as to maintain pawl **142** in a rotated or canted position.

As seen in FIGS. 4, 5, 7-9 and 13, clip applier **100** further includes a lock out **146** pivotally connected or supported in housing **104**. Lock out **146** includes a body portion **146a**, a first catch **146b** formed at one end of body portion **146a**, and a second catch **146c** extending from a side edge of body portion **146a**. First catch **146b** is configured and dimensioned to engage groove **192g** formed in the outer periphery of the inner rim of counter dial **192**. Second catch **146c** is configured and dimensioned to engage a notch **141c** formed in a side edge of rack member **141**. A biasing member **147** is provided to maintain first catch **146b** of lock out **146** in contact with the outer periphery of the inner rim of counter dial **192**.

Turning now to FIGS. 14-19B, the operation of clip applier **100** is provided. Prior to any initial squeezing of handles **106** of clip applier **100** and with clip applier **100** fully loaded with clips "C," as seen in FIGS. 14-14C, drive channel **140** is located at a proximal-most position, indicia **192b** of counter dial **192** of mechanical counter mechanism **190**, relating to a fully loaded clip applier **100**, in the present instance being fully loaded with twenty-two (22) clips, is visible through window **104c** formed in housing half **104b**. Accordingly, as seen in FIG. 14B, the numeral "22" is visible through window **104c**. Also, as seen in FIG. 14B, resilient finger **196a** of latch member **196** is engaged in a groove **192f** formed around the outer periphery of counter dial **192**.

As seen in FIG. 14C, prior to any squeezing of handles **106**, clutch pin **194d** of counter clutch **194** is disposed at a distal end of angled slot **140a** of drive channel **140**. Also, first catch **146b** of lock out **146** is in contact with the outer periphery of the inner rim of counter dial **192** so that second catch **146c** of

7

lock out 146 is disengaged from rack member 141. Moreover, prior to any squeezing of handles 106, and when clip applicer 100 is fully loaded with clips, groove 192g formed in the outer periphery of the inner rim of counter dial 192 is oriented distal of first catch 146b of lock out 146.

As seen in FIGS. 15-15B, during an initial squeeze of handles 106, as indicated by arrow "A1," drive pin 124 translates drive channel 140 and rack member 141 in a distal direction, as indicated by arrow "B1." As drive channel 140 is translated in a distal direction, angled slot 140a of drive channel 140 is moved in a distal direction relative to clutch pin 194d of counter clutch 194, clutch pin 194d is cammed through angled slot 140a of drive channel 140 causing counter clutch 194 to rotate in the direction of arrow "C1." As counter clutch 194 is rotated in the direction of arrow "C1," as seen in FIG. 15B, resilient fingers 194b, 194c thereof engage uni-directional teeth 192e of dial 192, thereby causing dial 192 to also rotate in the direction of arrow "C1." Moreover, as dial 192 is rotated in the direction of arrow "C1," groove 192g formed in the outer periphery of the inner rim of counter dial 192 is rotated away from first catch 146b of lock out 146 as first catch 146b continues to ride along the outer periphery of the inner rim of counter dial 192.

As dial 192 is rotated in the direction of arrow "C1," as seen in FIG. 15A, indicia 192b of numeral "22" is moved relative to window 104c formed in housing half 104b, thereby beginning to decrement. Additionally, as dial 192 is rotated in the direction of arrow "C1," resilient finger 196a of latch member 196 begins to disengage the groove 192f formed around the outer periphery of counter dial 192.

As seen in FIGS. 16-16B, during a final or complete squeeze of handles 106, as indicated by arrow "A1," drive pin 124 further translates drive channel 140 and rack member 141 in a distal direction, as indicated by arrow "B1." As drive channel 140 is further translated in a distal direction, angled slot 140a of drive channel 140 is further moved in a distal direction relative to clutch pin 194d of counter clutch 194, clutch pin 194d is further cammed through angled slot 140a of drive channel 140 causing counter clutch 194 to further rotate in the direction of arrow "C1." As counter clutch 194 is further rotated in the direction of arrow "C1," as seen in FIG. 16B, resilient fingers 194b, 194c continue to cause dial 192 to rotate in the direction of arrow "C1." Moreover, as dial 192 is further rotated in the direction of arrow "C1," groove 192g formed in the outer periphery of the inner rim of counter dial 192 is further rotated away from first catch 146b of lock out 146 as first catch 146b further continues to ride along the outer periphery of the inner rim of counter dial 192.

As dial 192 is further rotated in the direction of arrow "C1," as seen in FIG. 16A, indicia 192b of numeral "22" is completely moved out of view of window 104c formed in housing half 104b and new numeral "21" is moved into view of window 104c, thereby fully being decremented. This change of numeral, or decrementing, coinciding with a formation and/or firing/ejection/release of a clip from clip applicer 100. In this manner, the user is shown the number of clips remaining in clip applicer 100 and available to fire. Additionally, as dial 192 is further rotated in the direction of arrow "C1," resilient finger 196a of latch member 196 moves into engagement in a groove 192f/adjacent to groove 192f formed around the outer periphery of counter dial 192.

Turning now to FIGS. 17-18, during an opening of handles 106, as indicated by arrow "A2," drive pin 124 translates drive channel 140 and rack member 141 in a proximal direction, as indicated by arrow "B2." As drive channel 140 is translated in a proximal direction, angled slot 140a of drive channel 140 is moved in a proximal direction relative to clutch pin 194d of

8

counter clutch 194, clutch pin 194d is cammed through angled slot 140a of drive channel 140 causing counter clutch 194 to rotate in the direction of arrow "C2," opposite to "C1." As counter clutch 194 is rotated in the direction of arrow "C2," as seen in FIG. 17B, resilient fingers 194b, 194c are caused to deflect and snap over uni-directional teeth 192e of dial 192. As seen from FIG. 17A, any frictional forces tending to cause dial 192 to also rotate in the direction of arrow "C2" and negated by the engagement of resilient finger 196a of latch member 196 in groove 192f formed around the outer periphery of counter dial 192, thereby maintaining the rotational orientation of dial 192.

With dial 192 being held or maintained in this rotational orientation, indicia 192b of numeral "21" is maintained in view in window 104c.

As seen in FIG. 18, when drive channel 140 has been moved back to the fully proximal position, resilient fingers 194b, 194c of counter clutch 194 are re-set in engagement with adjacent uni-directional teeth 192e of dial 192.

Additionally, as dial 192 is further rotated in the direction of arrow "C1," resilient finger 196a of latch member 196 moves into engagement in a groove 192f/adjacent to groove 192f formed around the outer periphery of counter dial 192.

Turning now to FIGS. 19-19B, during the squeezing of handles 106, upon the firing of a final clip loaded in clip applicer 100, indicia 192b of dial in the form of numeral "0" is completely moved into view of window 104c formed in housing half 104b, thereby indicating to the user that no more clip are present in clip applicer 100. When dial 192 has been rotated to this position, as seen in FIGS. 19A and 19B, groove 192g formed in the outer periphery of the inner rim of counter dial 192 is rotated into registration with first catch 146b of lock out 146. In this position, biasing member 147, acting on lock out 146, urges first catch 146b of lock out 146 into groove 192g of dial 192.

Additionally, in the present position, second catch 146c of lock out 146 is moved into notch 141c formed in side edge of rack member 141 and thus into the path of proximal translation of rack member 141. Accordingly, as handles 106 are released and drive pin 124 begins to move rack member 141 in a proximal direction, notch 141c of rack member 141 engages second catch 146c of lock out 146 thereby prohibiting rack member 141 from returning to a proximal most or home position. With rack member 141 being inhibited or blocked from returning to the proximal most position, ratchet pawl 142 of ratchet mechanism 144 (see FIG. 5) is prevented from resetting itself. Since pawl 142 is prevented from resetting itself, handles 106 can not be re-actuated or re-squeezed since they have only been partially opened. Once again, reference may be made to U.S. Provisional Application No. 61/091,467, filed on Aug. 25, 2008, entitled "Surgical Clip Applicer;" U.S. Provisional Application No. 61/091,485, filed on Aug. 25, 2008, entitled "Surgical Clip Applicer and Method of Assembly;" and U.S. Provisional Application No. 61/286,569, filed on Dec. 15, 2009, entitled "Surgical Clip Applicer", for a detailed discussion of the structure, operation, and method of assembly of various components of surgical clip applicer 100.

It should be understood that the foregoing description is only illustrative of the present disclosure. Various alternatives and modifications can be devised by those skilled in the art without departing from the disclosure. Accordingly, the present disclosure is intended to embrace all such alternatives, modifications and variances. The embodiments described with reference to the attached drawing figures are presented only to demonstrate certain examples of the disclosure. Other elements, steps, methods and techniques that are

9

insubstantially different from those described above and/or in the appended claims are also intended to be within the scope of the disclosure.

What is claimed is:

1. A surgical clip applier, comprising:

a housing;

at least one handle pivotably connected to the housing;

a channel assembly extending distally from the housing;

a plurality of clips loaded in a clip carrier;

a drive channel translatable supported in the housing and the channel assembly, the drive channel being translated upon actuation of the at least one handle; and

a counter mechanism supported in the housing and including:

a counter dial rotatably supported in the housing;

a counter clutch operatively connected to the drive channel, the counter clutch concentrically and rotatably nested in a bore defined in the counter dial such that rotation of the counter clutch in a first direction results in rotation of the counter dial in the first direction, and rotation of the counter clutch in a second direction results in no rotation of the counter dial, wherein translation of the drive channel in a first direction relative to the counter mechanism directly causes the counter clutch to rotate in the first direction, and translation of the drive channel in a second direction relative to the counter mechanism directly causes the counter clutch to rotate in the second direction;

indicia disposed on the counter dial and visible through the housing, wherein the indicia corresponds to a quantity of clips loaded in the clip applier, wherein the indicia decrements upon each firing of the clip applier resulting in a reduction in the quantity of clips remaining of the plurality of clips.

2. The clip applier according to claim 1, wherein the counter clutch includes a uni-directional clutch member configured to rotate the counter dial in a single direction.

3. The clip applier according to claim 1, wherein the counter mechanism includes a latch member operatively engaged with the counter dial, wherein the latch member permits rotation of the counter dial in the first direction and inhibits rotation of the counter mechanism in a direction opposite to the first direction.

4. The clip applier according to claim 3, wherein the counter dial includes a plurality of grooves formed in an outer periphery thereof, and the latch member includes a resilient finger biased into engagement with the plurality of grooves of the counter dial.

5. The clip applier according to claim 1, wherein the counter clutch includes at least one resilient finger extending therefrom for engagement with uni-directional teeth formed in a perimetrical surface of the bore of the counter dial.

6. The clip applier according to claim 5, wherein the drive channel defines an angled slot therein, and wherein the counter clutch includes a clutch pin extending from a surface thereof and slidably disposed in the angled slot of the drive channel, wherein translation of the drive channel in the first direction relative to the counter mechanism causes the clutch pin to be cammed by the angled slot thereof thereby causing the counter clutch to rotate in the first direction, and translation of the drive channel in the second direction relative to the counter mechanism causes the clutch pin to be cammed by the angled slot thereof thereby causing the counter clutch to rotate in the second direction.

7. The clip applier according to claim 6, wherein the counter mechanism includes a latch member operatively engaged with the counter dial, wherein the latch member

10

permits rotation of the counter dial in the first direction and inhibits rotation of the counter mechanism in a direction opposite to the first direction.

8. The clip applier according to claim 7, wherein the counter dial includes a plurality of grooves formed in an outer periphery thereof, and the latch member includes a resilient finger biased into engagement with the plurality of grooves of the counter dial.

9. The clip applier according to claim 1, wherein the counter mechanism includes:

a lock out groove formed in an outer perimetrical edge of the counter dial; and

a lock out supported in the housing and biased such that a first catch thereof engages against the outer perimetrical edge of the counter dial,

wherein as the counter dial is rotated in the first direction and the lock out groove of the counter dial is brought into registration with the first catch of the lock out, the first catch of the lock out moves into and engages the lock out groove to inhibit further rotation of the counter dial in the first direction.

10. The clip applier according to claim 9, wherein the lock out includes a second catch, and wherein the second catch moves into a path of a translating member of the clip applier when the first catch of the lock out is moved into the lock out groove of the counter dial, thereby inhibiting a translation of the translating member of the clip applier.

11. The clip applier according to claim 10, wherein the lock out groove of the counter dial moves into registration with the first catch of the lock out when a final clip of the plurality of clips has been fired.

12. The clip applier according to claim 11, wherein the lock out groove of the counter dial is associated with the indicia on the counter mechanism indicating that the final clip has been fired.

13. The clip applier according to claim 12, wherein the indicia on the counter mechanism indicating that the final clip of the plurality of clip has been fired is represented by a number "zero".

14. The clip applier according to claim 10, further comprising a ratchet mechanism including:

a ratchet pawl pivotably supported in the housing; and

a rack member provided on the translating member, wherein the rack member is in operative registration with the ratchet pawl, and wherein the rack member translates across the ratchet pawl as the translating member translates.

15. The clip applier according to claim 14, wherein the ratchet mechanism is prevented from re-setting when the rack member has not completed a full translation.

16. A surgical clip applier, comprising:

a housing;

at least one handle pivotably connected to the housing;

a channel assembly extending distally from the housing;

a plurality of clips loaded in a clip carrier;

a drive channel translatable supported in the housing and the channel assembly, the drive channel being translated upon actuation of the at least one handle; and

a counter mechanism supported in the housing, the counter mechanism including indicia visible through the housing, wherein the indicia corresponds to a quantity of clips loaded in the clip applier, wherein the indicia decrements upon each firing of the clip applier resulting in a reduction in the quantity of clips remaining of the plurality of clips, the counter mechanism including a counter clutch concentrically and rotatably nested in a bore defined in the counter mechanism, the counter

11

clutch being operatively connected to the drive channel wherein translation of the drive channel in a first direction relative to the counter mechanism directly causes the counter clutch to pivot in a first direction, and translation of the drive channel in a second direction relative to the counter mechanism directly causes the counter clutch to pivot in a second direction. 5

17. The clip applier according to claim 16, wherein the counter mechanism is rotatably supported in the housing and the counter clutch is configured to rotate the counter mechanism in a single direction to decrement the indicia upon a pivot thereof. 10

18. The clip applier according to claim 16, wherein the counter mechanism includes a counter dial rotatably supported in the housing and including the indicia thereon, the counter clutch being nested concentrically within the counter dial and the counter mechanism. 15

19. The clip applier according to claim 18, wherein pivoting the counter clutch in the first direction results in rotation of the counter dial in the first direction, and pivoting the counter clutch in the second direction results in no rotation of the counter dial. 20

* * * * *

12